AVIATION · INVENTIONS · HOBBIES
MECHANIX ILLUSTRATED
MARCH
A FAWCETT PUBLICATION
Still 10¢
GET IN THE BIG "BUILDWORDS" CONTEST!
FREE
AERONCA AIRPLANE OR $1,500.00 IN WAR BONDS!

ONE great American army is still open for enlistments! It's the all-important army of *trained men*—whose *specialized* knowledge and skill are helping to win the war *today*, and will play a vital role in the victory-world of *tomorrow!*

You still have time to join these "industrial commandos." Even if you're over 38—or over 50!—training will make you a better fighter on the production front, and fit you for a better job when peace comes.

You can get your training as thousands of business and industrial leaders got theirs—by studying a low-cost I. C. S. Course in your spare time, at home! 400 business and technical subjects to choose from—one, or a combination of several, will fit you for greater success in *your* field!

Mail the coupon at the right for complete information on I. C. S. textbooks, teaching methods and personalized instruction.

NOTICE! *Please show this advertisement to your friends. Even if you have mailed the coupon, they can get prompt information by mailing a postcard or letter, telling their name, age, address and occupation, to* **Box 2317,**

INTERNATIONAL CORRESPONDENCE SCHOOLS
SCRANTON, PENNA.

FREE!

Mail coupon at right and we will send you sample lesson in Blueprint Reading — *free!*

PRINTED IN U.S.A.

army
ments!
rmy of
pecial-
ill are
today,
role in
orrow!
to join
andos."
38 — or
make
on the
it you
peace

raining
ss and
heirs —
I. C. S.
me, at
d tech-
e from
of sev-
greater

e right
on on
aching
alized

!

nd we
lesson
- free!

PRINTED IN U.S.A.

LOOK OVER THIS LIST OF I. C. S. COURSES— THEN MARK AND MAIL THE COUPON TODAY!

TECHNICAL COURSES

Air Conditioning Schools
Air Conditioning
Heating
Plumbing
Refrigeration
Steam Fitting

Chemistry Schools
Chemical Engineering
Chemistry, Analytical
Chemistry, Industrial
Chemistry, Mfg. Iron and Steel
Pulp and Paper Making

Civil, Architectural and Structural Engineering Schools
Architecture
Architectural Drafting
Bridge and Building Foreman
Bridge Engineering
Building Estimating
Civil Engineering
Concrete Engineering
Contracting and Building
Highway Engineering
Retail Lumberman
Structural Drafting
Structural Engineering
Surveying and Mapping

Electrical Schools
Electrical Engineering
Electric Wiring
Gas and Electric Welding
Industrial Electrician
Lighting Technician
Power House
Practical Telephony
Radio, General
Radio Operating
Radio Servicing
Telegraph Engineering

Internal Combustion Engines Schools
Automobile Technician
Aviation
Diesel—Electric
Diesel Engines
Gas Engines

Mechanical Schools
Airplane Drafting
Foundry Work
Heat Treatment of Metals
Inventing and Patenting
Machine Shop Practice
Mechanical Drafting
Mechanical Engineering
Metal Pattern Drafting
Mold Loft Work
Reading Shop Blueprints
Sheet Metal Worker
Ship Drafting
Ship Fitting
Shop Practice
Steel Mill Workers
Tool Designing
Wood Pattern Making

Railroad Courses
Air Brake
Car Inspector
Locomotive Engineer
Locomotive Fireman
Railroad Car Repairer
Railroad Section Foreman

Steam Engineering Schools
Boiler Making
Combustion Engineering
Engine Running
Marine Engines
Petroleum Refining Plant
Steam Electric
Steam Engines

Textile Schools
Cotton Manufacturing
Textile Designing
Woolen Manufacturing

BUSINESS and ACADEMIC COURSES

Academic Schools
Arithmetic
College Preparatory
First Year College
High School
Higher Mathematics
Illustrating

Business Schools
Accounting
Advertising
Bookkeeping
Business Correspondence
Business Management
Cert. Pub. Accounting
Commercial
Cost Accounting
Foremanship
Salesmanship
Secretarial
Stenography
Traffic Management

Civil Service Schools
City Letter Carrier
Post Office Clerk
Railway Postal Clerk

Language Schools
French
Good English
Spanish

INTERNATIONAL CORRESPONDENCE SCHOOLS
HELPING TO TRAIN AMERICANS FOR VICTORY

SPECIAL TUITION RATES FOR MEMBERS OF THE ARMED FORCES ★

BOX 2317, SCRANTON, PENNA.

★ Without cost or obligation, please send me *free sample lesson* in **Blueprint Reading**, and full particulars about your course ★

in_____

*Name*_____ *Age*_____

*Address*_____

*City*_____ *State*_____

*Present Position*_____

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

Be a Radio

MANY MAKE $30,

J. E. SMITH
President
National Radio
Institute
Est. 28 Years

Men I Train Win Success Like This

$10 a Week in Spare Time

"I repaired some Radio sets when I was on my tenth lesson. I really don't see how you can give so much for such a small amount of money. I made $600 in a year and a half, and I have made an average of $10 a week—just spare time." JOHN JERRY, 1337 Kalamath St., Denver, Colorado.

Salary Increased $1,800 Year in Radio

"I have been regularly employed in Radio since my graduation. I have been Chief Engineer of three broadcast stations, and at present time am Chief Engineer of WDOD. My salary has increased $1,800 per year since entering Radio and credit is given you for your excellent training." JULIUS C. VESSELS, Station WDOD, Chattanooga, Tenn.

$200 a Month in Own Business

"For several years I have been in business for myself making around $200 a month. Business has steadily increased. I have N. R. I. to thank for my start in this field." ARLIE J. FROEHNER, 300 W. Texas Ave. Goose Creek, Texas.

I Train BEGINNERS at Home for Good Spare Time and Full Time Radio Jobs

Here's your opportunity to get a good job in a busy wartime field with a bright peacetime future! There is a shortage today of trained Radio Technicians and Operators. If you're in a rut, worried because your present job offers no chance to get ahead—find out about RADIO!

Mail the Coupon for the FREE Lesson from my Radio Course described below. It shows you why N.R.I. training offers a quick way to more pay. And with this Lesson I will send you FREE my 64-page, illustrated book, RICH REWARDS IN RADIO. It describes many fascinating types of Radio jobs, tells how N.R.I. trains you at home in spare time, explains the unique training method which I have developed and perfected during my 28 years of teaching Radio by mail.

ACT NOW! Many Beginners Quickly Earn $5, $10 a Week Extra in Spare Time

Many N.R.I. Students make $5, $10 EXTRA MONEY fixing Radios in spare time while learning. I send EXTRA MONEY JOB SHEETS that tell how to do it!

Right now, probably in your neighborhood, there's room for more spare and full time Radio Technicians. The Radio repair business is booming, because no new Radios are being made. Many Radio Technicians are starting their own FULL time Radio businesses . . . making $30, $40, $50 a week.

Other trained Radio men take good-pay jobs with Broadcasting Stations. Many more are needed for Government jobs as Civilian Radio Operators, Technicians. Radio Manufacturers need trained Technicians to help fill Government wartime orders. Aviation, Commercial, Police Radio and Loudspeaker Systems are live, growing fields. And think of the NEW jobs Television, Frequency Modulation, and other Radio developments will open after the war! I give you the Radio knowledge required for jobs in these fields.

FREE Lesson in RADIO

Here is a Partial List of Subjects this Lesson Teaches

With 31 Photos, Sketches, Radio Drawings

How superheterodyne receivers work
How to remove tubes, tube shields
Three reasons why radio tubes fail
Electrodynamic loudspeaker: How it works
Replacing damaged cone
Recentering voice coil
Remedies for open field coil
Output transformer construction, repair
Gang tuning condenser: Construction of rotor, stator
How capacity varies
Restringing dial cord
Straightening bent rotor plates
I.F. transformers—What they do, repair hints
How to locate defective soldered joints
Inside story of carbon resistors
Paper, electrolytic, mica, trimmer condensers
How condensers became shorted, leaky
Antenna, oscillator coil facts
Power transformer: construction, possible troubles

Installing power cord
Troubles of combination volume control, on-off switch
Tone controls
Dial lamp connections
Receiver servicing technique: Checking performance
Testing tubes
Circuit disturbance test
Isolating defective stage
Locating defective part

FIND OUT ABOUT THIS TESTED WAY

Technician

$40, $50 A WEEK

How "the N. R. I. Method" Paves the Way to Good Pay

The up-to-the-minute Radio Technician must have BOTH a theoretical knowledge and a practical understanding of how to apply Radio principles. I give you thorough training in Radio Theory . . . show you how to use your knowledge. "The N.R.I. Method" trains you from the ground up—covers Fundamentals thoroughly: Radio Terms, Symbols, Diagrams, Receiver Troubles, Servicing, Television, FM Receivers, Transmitters, Cathode Ray Oscilloscopes, Electronic Controls, etc., are just a FEW of the subjects you'll cover before you finish my Course!

Extra Pay in Army, Navy, Too

Men likely to go into military service, soldiers, sailors, marines, should mail the coupon now! Learning Radio helps men get extra rank, extra prestige, more interesting duties, MUCH HIGHER PAY. Also prepares for good Radio jobs after service ends. Over 1,700 service men now enrolled.

A Great School Helps You Toward The Rich Rewards in Radio

Throughout your training, the staff and resources of the world's largest private institution devoted entirely to training men for Radio will be squarely behind you. N.R.I. has stuck to the one job of teaching Radio for 28 years. My entire staff of more than 100 people devotes full time to Radio training. Our combined efforts have made the Course so interesting, with hundreds of pictures, charts, and diagrams—so easy-to-grasp, with special teaching methods designed especially for home training—that we believe you will be "old friends" with Radio almost before you know it.

Find out What N. R. I. Can Do For YOU

MAIL THE COUPON. I'll send you the FREE Lesson and my 64-page illustrated book, RICH REWARDS IN RADIO. They're packed with Radio facts, things you never knew about opportunities in Broadcasting, Radio Servicing, Manufacturing, other Radio fields.

You'll read a description of my Course—Extra Money Job Sheets—Consultation Service—other special N.R.I. training features. You'll see the fascinating jobs Radio offers and how to learn Radio at home. You'll read many letters from men I trained, telling what they are doing, earning. And you'll have my FREE LESSON to keep. No obligation. Just MAIL THE COUPON—J. E. SMITH, President, National Radio Institute, Dept. 3CH, Washington, D. C.

Broadcasting stations employ N.R.I. trained Radio Technicians as operators, installation, maintenance men and in other capacities and pay well.

THIS Free Book HAS HELPED HUNDREDS OF MEN MAKE MORE MONEY

Set Servicing pays many N.R.I. trained Radio Technicians $30, $40, $50 a week. Others hold their regular jobs and make $5 to $10 extra a week in spare time.

Training Men for Vital Radio Jobs

TO BETTER PAY

Mail this to get 64 page book FREE

J. E. SMITH, President, Dept. 3CH
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Mail me FREE, without obligation, your sample lesson and 64-page book, "Rich Rewards in Radio," which points out Radio's opportunities and tells how you train men at home to be Radio Technicians. (No salesman will call. Please write or print plainly.)

Age.....

Name .....

Address .....

City..... State.....4FB-2

MARCH 1943

MECHANIX ILLUSTRATED

VOL. XXIX NO. 5

W. H. FAWCETT, Jr., President

Editors: Roland Cueva Bill Williams

Associate Editors: George Daniels, *Aviation;* Norman C. Lipton, *Photography;* Thomas J. Naughton, *News;* Gilbert Paust, *Crafts and Hobbies;* Mary Driscoll, *Production.*

Copyright 1943 by Fawcett Publications, Inc.

SPECIAL FEATURES

On the Cover: Modern Merlin—a welder at work in a plant where many of the welders paint witch-doctor faces on the masks they wear while making bad medicine for the Axis. Kodachrome by Balkin-Pix.

How I Kill Nazis At Night! - - - - - - - - 35
by Flight Lieutenant Karel Kuttelwascher, the R.A.F.'s ace night fighter

Doctor of Tools - - - - - - - - - - - - - 39
by Cecil Carnes—Inventions to Order

Exploring Life With Atomic Flares - - - - 42
by Ruth Ringle—pioneering advances in the search for health

Your Post-War Radio - - - - - - - - - - 46
by Donald G. Cooley—a machine you never dreamed of, sixth wonder in MI's series describing "A World You Never Knew"

How Parachutes Are Packed - - - - - - - 52

Goodbye To Blitz! - - - - - - - - - - - - 54
by Major Malcolm Wheeler-Nicholson—the tank meets its match

Soldier of Science - - - - - - - - - - - - 58
by Darrell Huff and L. N. Eldred—American victory on the science front

"A Miracle Saved Me" - - - - - - - - - - 62
Capt. Eddie Rickenbacker's own story of narrowly averted death in the Pacific

Transparent Bomber - - - - - - - - - - - 66
by Lt. Douglas Rolfe, R.A.F. (Hon)

YOUR CHANCE TO WIN A PLANE! - - - - 68
MI's Great 1943 Contest—Part II

Machine-Gun Movies! - - - - - - - - - - - 78

PLUS—16 Pages of News Flashes starting on - 79

AND—59 Pages of Crafts & Hobbies starting on 95

(Continued on page 8)

THE MECHANIX ILLUSTRATED ADVISORY INVENTIONS BOARD

WILBUR SHAW
Noted automotive engineer and inventor

CLYDE PANGBORN
Aviation pioneer

DR. LOUIS D. CLEMENT
Noted physicist, chemist and inventor

SIR HUBERT WILKINS
Scientist and explorer

DR. JAMES L. CLARK
Explorer and Assistant Curator of the American Museum of Natural History

LT. COMDR. BOB BARTLETT
U. S. Navy

ROBERT COLES
Noted astronomer, Assistant Curator of the Hayden Planetarium

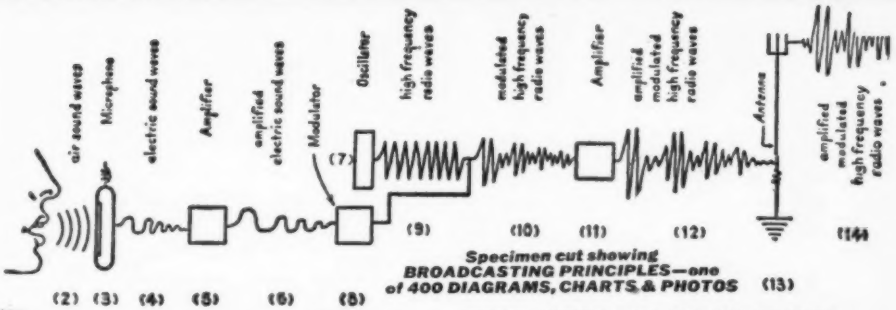
NEXT MONTH!

Maybe you've wondered sometimes why it is that the Squire of 77 Wistful Vista, otherwise known as Fibber McGee, never gets around to straightening out that hall closet! Well, the reason is, that he's too busy in his home workshop. You'd hardly believe it, how busy he is in that workshop! He's so busy there that—but let him give the whole story to you himself, including why he thinks sometimes he'd rather be known as Zipper-Lip McGee than as Fibber. Don't miss "My Day—In My Workshop" by Fibber (Zipper-Lip) McGee, in the April issue of MECHANIX ILLUSTRATED.

MECHANIX ILLUSTRATED is published monthly by Fawcett Publications, Inc., 1100 W. Broadway, Louisville, Ky. Printed in U. S. A. Advertising and Editorial Offices, Paramount Building, 1501 Broadway, New York, N. Y. General Offices, Fawcett Building, Greenwich, Conn. Elliott D. Odell, Advertising Director; Roscoe K. Fawcett, Circulation Director; Ralph Daigh, Editorial Director; Al Allard, Art Director. Entered as second-class matter at the post office at Louisville, Ky., under the act of March 3, 1879. Additional entry at Greenwich, Conn. Copyright 1943 by Fawcett Publications, Inc. Reprinting in whole or in part forbidden except by permission of the publishers. Title registered in the U. S. Patent Office. Address manuscripts to New York Editorial Offices. Not responsible for lost manuscripts or photos. Unacceptable contributions will be returned, if accompanied by sufficient first class postage. Price 10c per copy. Subscription price $1.00 per year in U. S. and possessions. Canadian subscriptions not accepted. Foreign subscriptions $2.00 per year. Foreign subscriptions and sales should be remitted by International Money Order in United States funds payable at Greenwich, Conn. Advertising forms close fifth of second month preceding date of issue.

MEMBER AUDIT BUREAU OF CIRCULATIONS

Audels RADIO -MANS GUIDE



Specimen cut showing
BROADCASTING PRINCIPLES—one of 400 DIAGRAMS, CHARTS & PHOTOS

(1) QUESTIONS AND ANSWERS

1001 FACTS

THE KEY TO PRACTICAL RADIO INFORMATION

Including Frequency Modulation—Television, etc.

Inside Information for Aviation, Marine, Commercial Operators and Technicians, Servicemen and Students

772 PAGES, 400 DIAGRAMS, CHARTS & PHOTOS

This well organized reading course in Radio is especially suitable for home study and as a ready reference guide to help you learn the inside facts about radio. The amount of mathematics required for a successful study of this book is fully covered as the various chapters include numerous practical radio problems, carefully worked out, step by step, to their final solution. The contents are PROGRESSIVELY ARRANGED AND CAREFULLY INDEXED.

LATE DATA—EASY TO READ AND UNDERSTAND

Gives Authentic Principles and Practices in Construction, Operation, Service & Repairs. Covers clearly and concisely Radio fundamentals—Ohm's Law—Physics of sound as related to radio science—Measuring instruments—Power supply—Resistors—Inductors—Condensers—Transformers and examples—Broadcasting stations—Radio Telephony—Receivers—Diagrams—Construction—Control systems—Loudspeakers—Antennas—Auto Radio—Phonograph pickups—Public Address Systems—Aircraft & Marine Radio—Radio Compass—Beacons—Automatic Radio Alarms—Short Wave—Coil Calculations—Testing—Cathode ray oscillographs—Static Elimination—Trouble Pointers—Underwriter's standards—Units & tables. REVIEW QUESTIONS—Ready Reference Index.

HIGHLY ENDORSED—ASK TO SEE IT ON 7 DAYS' FREE TRIAL

MAIL COUPON TODAY

THEO. AUDEL & CO., Publishers, 49 West 23rd St., New York

Mail AUDELS NEW RADIOMAN'S GUIDE for free examination. If O.K. I will send you $1 in 7 days; then remit $1 monthly until $4 is paid. Otherwise I will return it.

Name.....

Address.....

Occupation.....

Reference.....

M.M.

$4 COMPLETE PAY ONLY $1 A MO.

SHIPBUILDING

Basic Training at Home in Spare Time

America needs ships, more ships, and men trained to build them. Thousands of good pay opportunities. In many trades are opening now in this vast, fast-growing industry. World events point to continued demand for trained shipbuilding workers.

New Training Courses Now Ready

Shipbuilding workers, and men who want to enter shipbuilding—grasp this opportunity. Help your country and fill a top-pay job. In spare time at home, even without previous experience, you can get your basic training in ship blueprint reading, general ship construction and related trade instruction. Fit yourself to start, or to win promotion and bigger income. Turn your free hours into money. Act now.

American School, Dept. S328, Drexel Ave. at 58th St., Chicago, Ill.
Send me FREE information covering special training in subjects checked below. No obligation on my part.

☐ Ship Blueprint Reading
☐ Shipfitting
☐ Electrical Engineering
☐ Drafting and Design for Men and Women
☐ Diesel Engineering
☐ Mechanical Engineering
☐ Cost Accounting for Manufacturing
☐ Architecture & Building
☐ Plastics
☐ Business Management
☐ Aviation ☐ Radio
☐ High School Course

Name .....

Address .....

CASH IN ON

WARTIME PHOTOGRAPHY

—while preparing for sound future careers! Trained men and women photographers are needed now more than ever before. Qualify at largest, oldest school that has trained many of today's most successful photographers. Over 450 N.Y.I. trained men winning promotion, higher pay in photo divisions of Armed Service. Resident or home study courses. Big FREE book gives details.

N. Y. INSTITUTE OF PHOTOGRAPHY, Dept. 153, 10 W. 33 St., New York, N. Y.

TOUGH HOLDS

For
SELF DEFENSE
and
COUNTER ATTACK
Used by
United States Marines

Amazing JIU JITSU MILITARY MANUAL packed from cover to cover with TOUGH HOLDS, chokes, throws and gun-disarming instructions with graphic illustrations. A powerful defense and counter-attack system easy to learn. Makes you tough regardless of your size. Shows you how to handle brutes, even though armed, with your bare hands. Every Police Officer, Guard and every man and woman should have this book. Ideal for Service Men!

Leatherette Finish

$1.00 Postpaid

SEND NO MONEY—Just send us your order and pay postman $1.00, plus few cents postage. Or enclose dollar for postpaid delivery. To avoid delay men in camps should enclose dollar with order. Act now—prepare yourself for any emergency.

GORDY PUBLISHING COMPANY

58 E. 18th St., Dept. 32. Chicago, Ill.

CONTENTS—Continued from page 6

HOW-TO-BUILD FEATURES

Modern Houses of Earth - - - - 104
by Richard W. Haupt
Build Your Own Bicycle! - - - - 108
by Robert Wheeler
Mystify With Magnets! - - - - 114
by Ken Murray
Protective Alarm System For Your Home - - - - - - - 120
by Walter E. Burton
The School Shop—Aviation Lesson No. 2 - - - - 138
by Gilbert Paust

CRAFTS AND HOBBIES

Photography

Brome Etching - - - - - - - - - - 96
Monthly Contest Winners - - - - - - 97
Simplified Flash-Peak Tester - - - - - 98
Kinks For Conservation - - - - - - 100
Photo-Magic With Black Backgrounds - - 101

Workshop

Alabaster Carving - - - - - - - - 111
Ideas For Service Men - - - - - - - 112
Household Hints - - - - - - - - - 118
"Priority Wheel" With Wire Tires - - - 119
Automatic Parking Gauge - - - - - - 119
The Swingaroo - - - - - - - - - - 124
Priority-Proof Model Plane - - - - - - 125
Bill Bildit Makes An Aircraft Spotter - - 128
Power Hacksaw - - - - - - - - - 130
Precision Caliper - - - - - - - - - 133
Mils Vs. Degrees - - - - - - - - - 136
Machinist's Level Clamp - - - - - - - 137
Adapt Your Radio For Recording - - - - 142
Continuous, Dual Record Player - - - - 144
Lengthen Your Boat - - - - - - - - 146
Turned Walnut Lamp Of Eccentric Design - 150
Special Cutter For Corner Joints - - - - 152
"Panda" Jiggle Wagon - - - - - - - - 153

NEWS OF SCIENCE AND MECHANICS

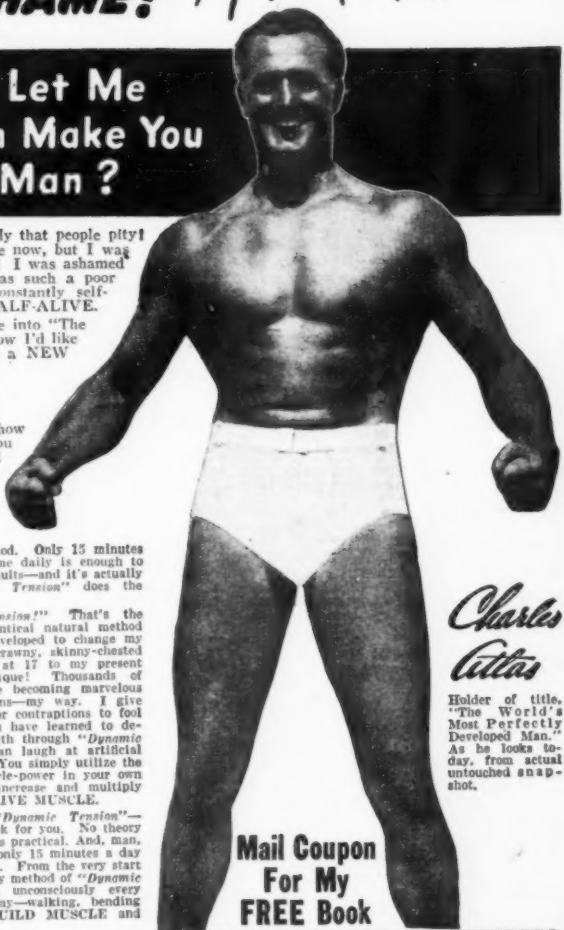
New Day For The Old Plantation - - - - - 79
Wartime Manhole Cover - - - - - - - 80
Costume For Blasting - - - - - - - - 80
Hamburgers To War Production - - - - - 80
Production-Front Flame-Thrower - - - - 81
Salt Water Tests Circuits - - - - - - 81
Vanishing Wall - - - - - - - - - 81
Battle Fleets In Miniature - - - - - - - 82

(Continued on page 10)

How to Make YOUR Body Bring You FAME ... Instead of SHAME!

ARE YOU Skinny? Weak? Flabby?

Will You Let Me Prove I Can Make You a New Man?



I KNOW what it means to have the kind of body that people pity! Of course, you wouldn't know it to look at me now, but I was once a skinny weakling who weighed only 97 lbs.! I was ashamed to strip for sports or undress for a swim. I was such a poor specimen of physical development that I was constantly self-conscious and embarrassed. And I felt only HALF-ALIVE.

But later I discovered the secret that turned me into "The World's Most Perfectly Developed Man." And now I'd like to prove to you that the same system can make a NEW MAN of YOU!

What Dynamic Tension Will Do For You

I don't care how old or young you are or how ashamed of your present physical condition you may be. If you can simply raise your arm and flex it I can add SOLID MUSCLE to your biceps—yes, on each arm—in double-quick time! Only 15 minutes a day—right in your own home—is all the time I ask of you! And there's no cost if I fail.

I can broaden your shoulders, strengthen your back, develop your whole muscular system INSIDE and OUTSIDE! I can add inches to your chest, give you a vise-like grip, make those legs of yours lithe and powerful. I can shoot new strength into your old backbone, exercise those inner organs, help you cram your body so full of pep, vigor and red-blooded vitality that you won't feel there's even "standing room" left for weakness and that lazy feeling! Before I get through with you I'll have your whole frame "measured" to a nice, beautiful suit of muscles!

Only 15 Minutes A Day

No "ifs," "ands" or "maybes." Just tell me where you want handsome, powerful muscles. Are you fat and flabby? Or skinny and gawky? Are you short-winded, pepless? Do you hold back and let others walk off with the prettiest girls, best jobs, etc.? Then write for details about *"Dynamic Tension"* and learn how I can make you a healthy, confident, powerful HE-MAN. *"Dynamic Tension"* is an entirely NATURAL method. Only 15 minutes of your spare time daily is enough to show amazing results—and it's actually fun. *"Dynamic Tension"* does the work.

"Dynamic Tension!" That's the ticket! The identical natural method that I myself developed to change my body from the scrawny, skinny-chested weakling I was at 17 to my present super-man physique! Thousands of other fellows are becoming marvelous physical specimens—my way. I give you no gadgets or contraptions to fool with. When you have learned to develop your strength through *"Dynamic Tension,"* you can laugh at artificial muscle-makers. You simply utilize the DORMANT muscle-power in your own body—watch it increase and multiply into real, solid LIVE MUSCLE.

My method—*"Dynamic Tension"*—will turn the trick for you. No theory—every exercise is practical. And, man, so easy! Spend only 15 minutes a day in your own home. From the very start you'll be using my method of *"Dynamic Tension"* almost unconsciously every minute of the day—walking, bending over, etc.—to BUILD MUSCLE and VITALITY.

Charles Atlas

Holder of title, "The World's Most Perfectly Developed Man." As he looks today, from actual untouched snapshot.

Mail Coupon For My FREE Book

FREE BOOK "EVERLASTING HEALTH AND STRENGTH"

In it I talk to you in straight-from-the-shoulder language. Packed with inspirational pictures of myself and pupils—fellows who became NEW MEN in strength, my way. Let me show you what I helped THEM do. See what I can do for YOU! For a real thrill, send for this book today, AT ONCE. CHARLES ATLAS, Dept. 63, 115 East 23rd Street, New York, N. Y.

CHARLES ATLAS, Dept. 63,
115 East 23rd Street, New York, N. Y.

I want the proof that your system of *"Dynamic Tension"* will help make a New Man of me—give me a healthy, husky body and big muscle development. Send me your free book, "Everlasting Health and Strength."

Name _____
(Please print or write plainly)

Address _____

City _____ State _____

☐ Check here if under 16 for Booklet A.

How to make a good living on a small farm

Want a small farm? Own one now? If you *do* want the enjoyment of security, a good living, pleasures of rural life, the freedom in being your own boss, FIVE ACRES AND INDEPENDENCE—the all-inclusive book by M. G. Kains, world's leading small farm expert—shows you how to select, how easily to run your farm successfully.

This book tells what kind of farm to rent or buy; how to choose it; finance it; what and how to plant; choice and care of livestock, poultry, bees, etc.; essentials of fruit and vegetable growing; fertilizers; irrigation; spraying; cultivation; harvesting; storage; sale of products and by-products. Every page packed with proved ways to make the small farm self-supporting—even profitable. Abundantly illustrated with workable plans and diagrams. Over 400 pages.

Plan now to get away from city worries, war shortages, high rents, inflation. Use this book as your guide. If not satisfied, return for full refund.

$2.50 FREE Examination

GREENBERG: PUBLISHER MI
400 Madison Ave., Dept. B, New York

Send me FIVE ACRES AND INDEPENDENCE at $2.50 postpaid. If not satisfied, I may return it within 7 days for full refund.

☐ Payment enclosed ☐ Send C. O. D.

NAME .....

ADDRESS .....

CITY & STATE.....

EARN MONEY PAINTING PORTRAITS

● No previous training or talent necessary. Unique Stuart System teaches you, by mail, in 10 simple, easy-to-follow lessons, to make excellent charcoal and oil likenesses. Detailed guidance for your every step. Send for free book *today*.

STUART STUDIOS,
121 Monument Circle, Room 203, Indianapolis, Ind.
Please send me free book and outline of lessons.

Name .....
Street .....
City ..... *State* .....

Get this Handy OHMITE Ohm's Law Calculator!

Figures Ohms, Watts, Volts, Amperes—Quickly, Easily!

Solves any Ohm's Law Problem with one setting of the slide. Requires no slide rule knowledge. All values are direct reading. Scales on two sides cover the range of currents, resistances, wattages and voltages commonly used in Radio and Electrical Work. Size 4⅛" x 9".

Send only 10c in coin to cover cost of handling.

OHMITE MFG. CO. 4979 Flournoy St., Chicago, Ill.

CONTENTS—Continued from page 8

Paper Boat - - - - - - - - - - - 82
Army Air Forces Save Metal - - - - - - 83
Get Yourself A Shine - - - - - - - 83
Electric Gauges Speed Production - - - - 83
No Pinpricks, Please - - - - - - - - 84
Now It's Rubber Paint - - - - - - - 84
Dress Your Inner Tube In A Sweater - - 84
Ground-Bound Test Pilot - - - - - - 85
The Serious Sleeper - - - - - - - - 86

NEWS OF MODERN WARFARE

The Spitfire Grows Up - - - - - - - 87
Sowing Death For Axis Ships - - - - - 88
Fashion For The Stratosphere - - - - - 88
Something New In Air Power - - - - - 89
Transport For War - - - - - - - - 90
Fighting Fire With Gas - - - - - - - 90
Chemical Towels For Warplane Motors - - 90
New Target For Spitfires - - - - - - 91
Wooden Aerial Freighter - - - - - - 91
Concrete Phantom - - - - - - - - - 92
Canadian Mosquito - - - - - - - - 92
Seven Pounds Of Sudden Death - - - - 93
Super-Harbor For San Francisco - - - - 94

AVIATION

How I Kill Nazis At Night! - - - - - - 35
How Parachutes Are Packed - - - - - - 52
Transparent Bomber - - - - - - - - 66
Machine-Gun Movies! - - - - - - - - 78
Ground-Bound Test Pilot - - - - - - 85
The Spitfire Grows Up - - - - - - - 87
Sowing Death For Axis Ships - - - - - 88
Fashion For The Stratosphere - - - - - 88
Fighting Fire With Gas - - - - - - - 90
New Target For Spitfires - - - - - - - 91
Wooden Aerial Freighter - - - - - - - 91
Canadian Mosquito - - - - - - - - - 92
Priority-Proof Model Plane - - - - - - 125
Aviation Lesson - - - - - - - - - 138

DEPARTMENTS

Your Invention Clinic - - - - - - - - 12
Chips From The Editor's Workbench - - - 14
Moneymakers and Moneysavers - - - - - 27
(Classified Ads)
News Of Science And Mechanics - - - - 79
News Of Modern Warfare - - - - - - - 87
Photography - - - - - - - - - - 95
How-To-Build Section - - - - - - - - 104
Home Aids - - - - - - - - - - - 118
The School Shop - - - - - - - - - 138
Your Wartime Car - - - - - - - - - 186

GET ON THE TECHNICAL FRONT

of U. S. Govt. or Civilian Service

Now, as never before, the urgent need for trained Radio men has created a tremendous shortage. Radio engineers, service men and marine operators, experts in shops, in factories and in laboratories are needed. War has stimulated demand in both civilian and military fields. Regardless of whether you remain a civilian or enter military service, National Radio Training will qualify you for a real future, a better pay job, responsibility and marvelous opportunity for advancement on the nation's technical front and later after the war.

REAL, ESTABLISHED SCHOOL TRAINS YOU

Every phase of your training is personally supervised by an established faculty of practical, experienced instructors and engineers. They have developed progressive methods of training you in your home comparable to actual shop practice. National Schools has trained ambitious men for top pay trades for 38 years. Every home assignment you receive is pretested and proved in modern, completely equipped Radio training shops. You learn the practical way.

BE A RADIO TECHNICIAN

More than 50,000,000 radios in use. They need servicing. Over 800 broadcasting studios employ trained radio technicians. The movie industry and thousands of theaters employ Sound Experts. Factories are adopting audible address systems. The air lines need trained men. The Army, Navy, Marines and Air Forces have tremendous demands for trained Radio Technicians. Here is your opportunity to get into a permanent, profitable field of fascinating work in the field you want.

Now you can learn AT HOME in your spare time. National's VICTORY training plan speeds up your progress right from the start, yet omits nothing vital to your preparation.

SHOP METHOD HOME TRAINING

fully qualifies you for good pay jobs

National's plan of rapid Home Training actually brings you the proved Shop-Studio-Field service methods that are followed in National's resident training shops. This training is simplified so that you can easily grasp radio step-by-step in a way that grows in its fascination every day. No previous experience needed. When you complete your Radio Course you are prepared for a good radio job at excellent pay or may establish your own radio business.

MEN SUBJECT TO MILITARY SERVICE AIDED

Radio training helps men get extra rank, extra pay in war service. Every man eligible for service should mail Coupon. Many service men now enrolled.

TEST THIS TRAINING BEFORE YOU ENROLL

So that you can demonstrate to yourself the ease and rapidity of learning Radio at home, National Schools will present to you one complimentary lesson free, accompanied by Opportunity Book of Facts and Details about all branches of radio. Use the Coupon. Mail it today!

Keep Job While Learning

Regardless of previous education or age, you can train for radio. Continue your present job. Earn while you learn. If subject to military service, all the more important that you get pretraining.

THOUSANDS OF GRADUATES ATTRIBUTE THEIR SUCCESS TO NATIONAL TRAINING

Qualify for These Jobs

Radio Expert
Broadcasting
Aircraft-Marine
Indust. Electronics
Studio Technician
Govt. Service
Remanufacture

FREE LESSON & OPPORTUNITY BOOK

Men of all ages can enroll

NATIONAL SCHOOLS

Los Angeles California

ESTABLISHED 1905

SEND NO MONEY - JUST THE COUPON

If you are dissatisfied with your present job and want to establish yourself on a more substantial basis for the years to come, the mailing of this Coupon is your starting point. It brings complete information How to Get into Radio. No obligation.

MAIL OPPORTUNITY COUPON FOR QUICK ACTION

National Schools, Dept. MI-3
4000 S. Figueroa, Los Angeles, Calif.

(Mail in envelope or paste on penny postal.)

MAIL me FREE, without obligation, one Lesson and Opportunity Book, with full details about how I can become a Radio Technician.

NAME _____ AGE _____

ADDRESS _____

CITY _____ STATE _____

YOUR INVENTION CLINIC

Conducted by

JOSEPH H. KRAUS

Mr. Kraus has been giving advice to inventors for more than 20 years. He will attempt to answer as many letters from inventors as possible in his column each month. Mr. Kraus will "call his shots as he sees them" in this column. Thoroughly versed on inventions and inventions procedure, he will never, under any circumstances, disclose any valuable secrets. He cannot answer questions relating to patent law. For such information, the Editors suggest you communicate with any one of the patent attorneys who advertise in MECHANIX ILLUSTRATED.

Airplane Take-Off

Pvt. Joseph Ekes, Jr., Camp McCoy, Wis., writes: "I was working on a method to allow a plane to take off from a small space but entered the services before I had time to complete this invention.

Pvt. Ekes then outlines a tethering arrangement which keeps the plane in a small but expansible circular path until sufficient speed has been attained for take-off.

ANSWER: *Obviously, this method requires much more space than is needed with the modern catapult. It also necessitates the addition of other controls. Its drawbacks could be pointed out by any pilot; chief of them is that the plane in its circular motion about the tether meets wind conditions from all angles and these must be compensated for.*

The plan is not new. It was described and illustrated during the last war in a somewhat better form. A sort of trapeze depending from an arm, which in turn extended horizontally from a central mast, was mounted so that it could be rotated by a motor. The plane was hooked to the trapeze. The equipment theoretically could be used for both landing and take-off; it being merely necessary to rotate the horizontal arm at a speed comparable with that of the plane encircling the pylon.

We do not believe that this suggestion would be looked upon favorably today. Its operation is too dangerous for moving planes.

Wooden Tires—Novelty Handkerchief

F. W. Phelan, Windsor, Ont., Can., sends us a design of a sectional wood tire of unique construction and also a design for a breast pocket handkerchief. He asks for our advice.

ANSWER: *The hardwood tire which you propose is, in our opinion, cleverly designed. But hardwood tires have not as yet been accepted although demonstrations of their usefulness have been given. We believe that by the time you could patent the hardwood tire, America will have synthetic rubber tires. Hard wood cannot substitute for natural rubber or synthetic tires.*

We hold that the sections of your tire cannot be replaced as easily as you imagine because, as the tires wear and as the wood parts become flattened through use, it would become difficult to separate the sections and fit a new section in place.

The vest pocket handkerchief novelty is not new. Similar fabric corners fastened to pieces of carboard with staples or cement were sold for many years on the New York markets. Apparently, the public objects to this subterfuge which is likely to cause considerable ridicule if some "friend" decides to pull the handkerchief out of the pocket.

We would not recommend action on either of these projects.

Screen Door Spring

C. R. Alloway of Altoona, Pa., submits a model of an adjustable screen door spring and asks us to give a "candid opinion in all details." He states that he had a patent search made by a patent attorney and has been informed that there is nothing similar on record.

ANSWER: *We believe that the method which you have developed is very clever but we wonder whether the unit can be made to sell profitably. There is no doubt but that the adjustment is simple. However, it would be more simple and more economical merely to bend a hook at the end of the spring and drop this hook into holes in the adjustable bar. Furthermore, this bar is too long and must be built quite solidly. Again, we would imagine that a simple sliding arrangement or a tension wheel (which could be manufactured at no greater cost) would serve the same purpose, would use less material and would not be as objectionable on a screen door.*

It is likely that your adjustable unit might be adapted to other uses. Our advice would be for you to try to unearth as many uses for such an adjustment as possible. Perhaps it could be applied to shop tools or to some of the controls on automobiles and the like.

If a fair list of such uses can be developed we would recommend further action. If not, we would

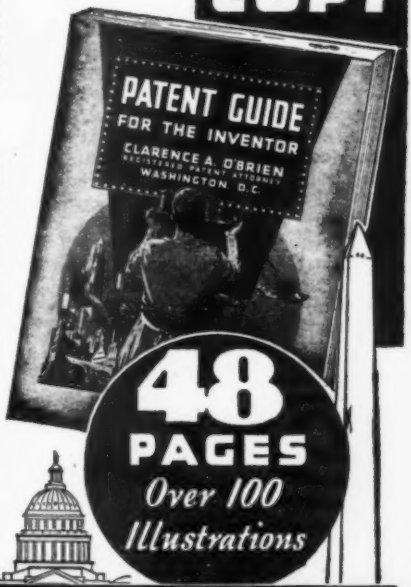
[Continued on page 163]

INVENTORS

NOW is the Time to PATENT and SELL Your Invention

Get FREE COPY

Now, more than ever before, is the right time to patent your invention. Why? Because manufacturers everywhere presently engaged in war production are looking ahead to the future by buying up patent rights now, so they will have new and attractive items to make and sell for civilian consumption as soon as the war is over. This is what happened during and after the last war. Hence, the smart thing for you to do is to look ahead to the future too. Protect your invention by applying for a patent now, so you will be in position to cash in on an outright sale, or on the royalties your invention will bring.



48 PAGES
Over 100 Illustrations

Patent Guide Shows What To Do

Our "Patent Guide for the Inventor" answers many important questions concerning Patents that inventors constantly ask. It tells what facts, details, drawings, sketches, etc. are necessary to apply for a Patent; how to protect your invention through dated and witnessed disclosure; how to do this AT ONCE to safeguard your rights; how Patent Office Records can be checked to determine whether the invention is probably patentable before filing fees need be paid; discusses costs involved and a practical way these can be paid as the application progresses. It tells how some inventors secured financial backing; how many simple inventions have proved large commercial successes; how Patents covering improvements also can be profitably utilized and marketed; tells countless other facts of interest.

Why You Need Expert Assistance

The Patent Laws were enacted for your benefit—to give you protection for the features of your invention which are Patentable. But these features must be legally and concisely set forth in the form of "claims." This phase of the procedure is so complex that the Patent Office advises the Inventor to engage a competent Registered Patent Attorney. We maintain a large staff—carefully trained registered patent attorneys—expert draftsmen—experienced searchers—to serve you. We have been serving inventors for more than 20 years.

Take First Step Now

With the Patent Guide you will receive also Free a "Record of Invention" form which will enable you at once to establish the date of your invention, before you file your Patent application. This step costs you nothing yet may be vital to your success. Remember—in Patent Matters, ACTION is IMPORTANT. Delay can be costly. Mail the coupon in an envelope, or paste it on a penny postcard NOW.

CLARENCE A. O'BRIEN
and
HARVEY B. JACOBSON
"Worthy of Your Trust"
Registered Patent Attorneys
33-C Adams Building
Washington, D. C.

Get This FREE BOOK
IMMEDIATELY MAIL COUPON TODAY!

CLARENCE A. O'BRIEN and HARVEY B. JACOBSON

CLARENCE A. O'BRIEN
and
HARVEY B. JACOBSON

CLARENCE A. O'BRIEN AND HARVEY B. JACOBSON
Registered Patent Attorneys before the United States Patent Office
33-C Adams Building, Washington, D. C.

Please send me your 48-Page "Patent Guide for the Inventor" and your specially prepared "Record of Invention" form FREE. This request does not obligate me.

Name .....

Address .....

City..... State.....
(Please write or print plainly.)

CHIPS *from the* EDITOR'S WORKBENCH

Get Going, Boys!

THE second puzzle in MI's great "Buildwords" contest is printed in this issue. If you haven't already started playing the "Buildwords" game, start NOW, by all means! For your convenience, if you missed the February issue, we are reprinting Puzzle No. 1 on page 183. You may use this blank—or your own copy of it, if you wish—as your first entry in the contest.

For, what a contest it is! Imagine: a brand new Aeronca Defender Training airplane—or your choice of $1,500 in War Bonds—as first prize. A beautiful Hamilton 19-jewel strap watch, a Sky Champion radio by Hallicrafters, and scores of other swell prizes, too!

Incidentally, in some of the text explaining the game last month, we inadvertently said the letter "M" had the greatest value whereas it was apparent the letter "L" was highest. These letter values change from month to month, so we wish particularly to ask you to study the letter values carefully on each puzzle.

Anyway, fellows and girls, let's get going on this great game! Turn to page 68 now!

Workman's Paradise

NEXT month we're going to take you to Paradise—to a workman's paradise, at any rate. We're going to give you a peek inside the fabulous plant of Jack & Heintz, at Cleveland, Ohio, where the worker is King—and we don't mean maybe.

All of you who work in defense plants, or at machine shops, at lathes or on production lines will get a kick out of this story. For there really is nothing like it anywhere else in the world. At Jack & Heintz, there is no time-clock; you get free coffee, free doughnuts, vitamin pills and soft drinks all the time; you get an expense-paid two-weeks' vacation in Florida; the boss supplies you with specially built shoes, with special bonuses—and with a band to keep you entertained. But the whole story is so fresh and unbelievable we know you'll get a tremendous kick out of it. So remind yourself now to buy the April MECHANIX ILLUSTRATED.

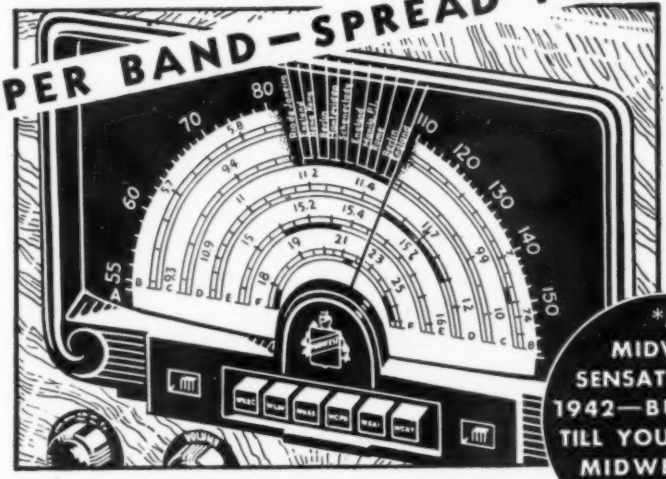
In the same issue, you'll find a first-person story by one of the most famous of all workbench nuts—Fibber McGee, of radio's "Fibber McGee and Molly." Fibber, who is James Jordan in real life,

This slick PT boat was built from plans in the January issue of MI by Martin P. Walsh, 6630 Lindenwood Place, St. Louis, Mo. It's unnecessary to say that Martin, Jr., gets a big kick out of his realistic new toy. This picture wins him the $5.00 Workbench Award.

WATCH ★ ★ ★ ★ MIDWEST

AFTER THE WAR IS WON ★ ★ ★
FOR SENSATIONAL ADVANCEMENTS
AND FEATURES SUCH AS • • •

SUPER BAND-SPREAD TUNING*



*A MIDWEST SENSATION IN 1942—BUT WAIT TILL YOU SEE THE MIDWEST OF TOMORROW

OUR ENTIRE PRODUCTION FACILITIES ARE NOW DEVOTED TO MANUFACTURING RADIO EQUIPMENT FOR OUR ARMED FORCES

BUT... WHEN VICTORY IS WON

YOU'LL BE BUYING YOUR MIDWEST RADIO DIRECT FROM THE FACTORY

SAVING UP TO **50%**
WILL BE JUST AS POPULAR AS EVER

Yes, Sir. Thousands upon thousands of people all over the U. S. were buying super powerful Midwest Radios direct from our factory until "Pearl Harbor" and if the many letters we are still receiving every day is an indication, the direct-to-user-plan will be more popular than ever after the War is won.

FREE
FOR A LIMITED TIME ONLY

A beautiful 12" x 8" "Old Glory" Calendar in full colors absolutely free if you send 10 cents for a U. S. War Savings Stamp. Just send a dime or 10¢ in postage stamps and your Calendar and War Savings Stamp will be sent promptly.

MIDWEST RADIO CORPORATION
DEPT. 10-A CINCINNATI, OHIO

SPRAYBERRY RADIO TRAINING includes FULL EQUIPMENT

Experience Easily Acquired at Home

You Do Practice-Giving Experiments, Many Special Features . . ALL Designed to Help You Make Fast Progress.

SPRAYBERRY Training starts right at the beginning of Radio . . . unfolds each subject in a simplified, logical, understandable style. You easily learn Television, Frequency Modulation, Signal Tracing, Mobile Radio (Auto-Tank), Aviation, Radio, Electronics, Facsimile Radio, Radio Set Repair and Installation work.

Training Prepares You for a Business of Your Own . . . or Good Radio Jobs—Civilian or Military

The important and fascinating field of Radio offers many opportunities to the man who wants to get ahead. My Training will help you win quick promotion in the Army or Navy . . . will fit you for a bright civilian career. SPRAYBERRY Methods are thorough and practical. Your Training will not interfere with your present duties.

You Get a Dual-Purpose Radio Set

I supply you with Radio Parts which you use to gain pre-experience in Repair work. These same Parts are used as a Modern Signal Generator and for Signal Tracing, etc. You'll find my Course and Equipment fully described in the catalog offered below.

No Previous Experience Needed

It makes no difference what your education has been. I can fit you quickly for a good-paying Radio job. I make it easy for you to grasp Radio principles and remember them. Your success is my full responsibility.

Earn While You Learn

My BUSINESS BUILDERS show you how to put your equipment to actual use in handling Money-making Radio Service Jobs shortly after you begin Training.

THE SPRAYBERRY COURSE IS SOLD UNDER MONEY-BACK AGREEMENT

RUSH COUPON for BIG FREE BOOK

SPRAYBERRY ACADEMY OF RADIO
F. L. Sprayberry, President
1518-C University Place, N. W.
Washington, D. C.

Please rush my FREE copy of "HOW TO MAKE MONEY IN RADIO."

Name..... Age.....

Address .....

City..... State.....

(Mail in envelope or paste on penny postcard)

Editor's Workbench Chips

is a dyed-in-the-wool woodworking fan, and his story will be accompanied by photos showing his dream-world woodworking shop. McGee tells you all his trials and tribulations in this screamingly funny article, "My Day—in My Workshop." And it's really funny, McGee!

You'll want to get the April issue, too, to read about a new discovery that may revolutionize the field of color photography, the "Iriscope." The Iriscope, believe it or not, enables you to project *black and white* films in *natural color!*

Don Cooley leads you into the new world of electronics, also, in the seventh in the MI series, "A World You Never Knew."

There'll be many other thrilling and entertaining features in the next issue, as well as page after page of workshop and hobby news and how-to-build features. Better go to your favorite newsstand and reserve your copy now.

Man in a Hurry

OUR favorite story about Henry J. Kaiser, the magician of the ship building world, who slaps Liberty ships together in three or four days'

ANOTHER "BONNIE" MAKES GOOD

"Victory" is the name of this *Bonnie* class boat built by Joseph W. Common, of 2410 Hills Street, Flint, Mich.

"This summer," writes Mr. Common, "we have sailed her on Lake Huron with great success, and recommend the design highly."

That's the way *Bonnie* builders always feel if they do as good a construction job as Mr. Common did. This snapshot brings him a $3.00 Workbench award and a Certificate of Merit.

SAVE MONEY
ON THIS BIG BOOK BARGAIN!

YES, you can save money on group purchases of these excellent books by availing yourself of this big bargain offer! These are exactly the same volumes which have sold by the tens of thousands at 50c apiece. But this special group offer cuts the price drastically.

These books are packed from cover to cover with fascinating articles and useful information. Each volume contains 176 pages and will be a valuable and permanent addition to your library or workbench.

This special offer permits you to buy the books illustrated on this page, by mail only, at the following bargain rates: *one book 50 cents; two books, 75 cents; three books, $1.00; four books, $1.25; five books, $1.50; all six, $1.75.* Read the descriptions of each book below, fill out the coupon and mail your order today!

FLYING MANUAL (No. 6)—A one-volume summary of everything you want to know about planes, flying, gliders, models, etc. Thrilling articles by leading pilots and aviation exports including General H. H. Arnold, Chief of the U. S. Air Corps. Explains three different ways to learn to fly free. "How To Get Your Pilot Certificate," "So You Want a Job in Aviation?" and dozens of other subjects thoroughly and entertainingly covered.

HOW TO BUILD 20 BOATS (No. 6)—Twenty complete and accurate designs that bring a boat within the means of everyone. You can build craft ranging from 8 foot prams to 26 foot deluxe cruisers from these simple plans and specifications. All instructions are detailed and easy to follow. Also special articles on boat maintenance.

HANDY MAN'S HOME MANUAL (No. 5)—A hundred and one easy ways to improve your home and keep it in good repair without paying for outside help. Packed with money-saving ideas, suggestions, and shortcuts for the home owner or renter. Also many practical workshop projects. Here's a book that will quickly repay the purchase price many times over.

LAWN AND GARDEN (No. 1)—This is a complete guide for the home gardener covering all phases of outdoor and indoor planting and growing. It is a one-volume gardening library written in non-technical language and packed with pictures, diagrams and instructions that will help you start a fine garden or improve the one you have. All articles written by experts.

40 HOMES AND PLANS FOR BUILDING (No. 1)—This book contains complete descriptions, beautiful photographs, plans and specifications for 40 small homes of superior design and value. Invaluable information on how you can finance a small home of your own. This book offers you complete blueprints at a saving of from $200 to $300 over the normal cost. No one interested in owning his own home should be without this book.

REMODEL YOUR HOME—Contains a multitude of ideas and plans for inexpensive remodeling and improvement of your home, garage, cottage. Included are plans for making a recreation room out of a basement; modernizing the kitchen; adding a sun porch, and many similar projects. Also full details of how to obtain cash to finance your remodeling requirements. Fully illustrated with "before and after" photographs.

FAWCETT PUBLICATIONS, Inc. MI-3
Greenwich, Conn.

Please send me the book(s) I have checked below. Enclosed find check, money order, cash or stamps amounting to: 50c for one book; 75c for two; $1.00 for three; $1.25 for four; $1.50 for five; $1.75 for six. All books sent postpaid.

☐ FLYING MANUAL No. 6 ☐ LAWN AND GARDEN No. 1
☐ HOW TO BUILD 20 BOATS No. 6 ☐ HOMES AND PLANS No. 1
☐ HANDY MAN'S HOME MANUAL No. 5 ☐ REMODEL YOUR HOME

Name .....

Address .....

City ..... State .....
(Canadian Orders Not Accepted)

AUDELS Carpenters and Builders Guides 4 vols. $6

Inside Trade Information

for Carpenters, Builders, Joiners, Building Mechanics and all Woodworkers. These Guides give you the short-cut instructions that you want—including new methods, ideas, solutions, plans, systems and money saving suggestions. An easy progressive course for the apprentice and student. A practical daily helper and Quick Reference for the master worker. Carpenters everywhere are using these Guides as a Helping Hand to Easier Work, Better Work and Better Pay. To get this assistance for yourself, simply fill in and mail the FREE COUPON below.

Inside Trade Information On:

How to use the steel square—How to file and set saws—How to build furniture—How to use a mitre box—How to use the chalk line—How to use rules and scales—How to make joints—Carpenters arithmetic—Solving mensuration problems—Estimating strength of timbers—How to set girders and sills—How to frame houses and roofs—How to estimate costs—How to build houses, barns, garages, bungalows, etc.—How to read and draw plans—Drawing up specifications—How to excavate—How to use settings 12, 13 and 17 on the steel square—How to build hoists and scaffolds—Skylights—How to build stairs—How to put on interior trim—How to hang doors—How to lath—lay floors—How to paint

THEO. AUDEL & CO., 49 W. 23rd St., New York City

Mail Audels Carpenters and Builders Guides, 4 vols., on 7 days' free trial. If O.K. I will remit $1 in 7 days, and $1 monthly until $6 is paid. Otherwise I will return them. No obligation unless I am satisfied.

Name.....

Address.....

Occupation.....

Reference..... MM

MONEY for MEN ALL DATA FREE

THE PLASTEX Industry needs manufacturers on small scale and for big production of Lamp and Clock Stands, Art Goods and Novelties in Plastex and Marble imitation. Experience unnecessary. The material makes regular 10c store sellers. Rubber molds furnished for speed production. Small investment brings good returns. We are now placing big chain store orders with manufacturers. Ambitious men have chance for real prosperity. Our free booklet will interest and benefit you.

PLASTEX INDUSTRIES

Dept. 3 1085 Washington Ave. New York, N. Y.

"MY JOB'S IMPORTANT! IS YOURS?
AIRCRAFT INSTRUMENT MEN NEEDED AT ONCE!"

PREPARE in AVIATION'S *MOST VITAL BRANCH*

AIRCRAFT INSTRUMENTS

HOME STUDY—LEARN BY DOING!

Practical, complete training—on actual instruments furnished by the school—qualifies you for well-paying positions with manufacturers, airlines and instrument service and repair stations.

Send for CATALOG today . . .

EASTERN AIRCRAFT INSTRUMENT SCHOOL

"Largest in the East"

DEPT. M 116 NEWARK AVENUE JERSEY CITY, N. J.

Editor's Workbench Chips

time, has to do with a visit Mr. Kaiser made recently to Washington.

He was late for a conference with magazine and newspaper men. Mr. Hurry-Up came bustling in full of apologies.

"I'm sorry I'm so late, boys," he blustered, "but—would you believe it—I had to wait over 30 minutes at the Union Station before I could get a taxicab."

"Why, Mr. Kaiser," exclaimed one of the newspapermen, "if you had to wait that long, why didn't you just build yourself a taxicab?"

Pise De Terre

THOUGH you may not be familiar with the above French expression, it describes one of the oldest construction projects known to man; dwellings built of earth. Buildings of *pise de terre*, or "rammed earth" as they are called in the United States were erected by the Romans, who carried the method into France and Britain. Being smart lads, the Romans found out most of the secrets of satisfactory rammed earth construction, and some of their *pise* buildings stood intact for hundreds of years.

Today, we can produce far better rammed earth buildings than the Romans, thanks to modern building methods and chemistry. The addition of an asphaltic emulsion to the earth mixture when in preparation "stabilizes" it and renders it immune to the weather. Hence moisture, formerly one of the chief enemies of any type of earth building, has been largely rendered harmless.

Strangely enough, little has been published in America regarding *pise de terre* construction, though the country is liberally dotted with such

A SEAT FOR BABY

This snappy little bicycle sidecar is the work of Zenos M. Baer, of 206 Division Street, Akron, O. The framework is mainly of welded gas pipe, although the sidecar body is a sort of de luxe model, having an upholstered seat and a watch—so the occupant won't miss appointments, perhaps.

Mr. Baer informs us that he will supply further details to MI readers who write him, enclosing a stamped, self-addressed envelope for a reply. Mr. Baer gets a $3.00 Workbench award and a Certificate of Merit.

Editor's Workbench Chips

houses, at least one of them more than 150 years old. The sod houses constructed on the Western plains by early settlers were a crude form of earth dwelling, and practically everyone who has been in California has been impressed by the beauty and durability of the adobe Missions and other "baked" earth buildings.

The United States Government has recently taken an interest in developing rammed earth construction, and has built a number of experimental houses of this material in various parts of the country.

So far the experiments have proved very satisfactory, and Farmers' Bulletin No. 1500, put out by the Dept. of Agriculture, says, "*Pise de terre* is a reliable building material when properly handled and is admirably adapted to structures on farms distant from transport routes."

The above was, of course, written before the war, so could not point out that the shortages of materials caused by the conflict has given a new significance and impetus to earth construction. While *pise de terre* naturally cannot solve all of Uncle Sam's housing problems, it may be a step in that direction. Considerable money can be saved in building *pise* houses, because all the walls come right from the land under the foundations; and as no special skill is needed for the ramming process, a man can round up some helpers and do the job himself. An example of this is the home-building project recently started in Detroit, known as Co-operative Homesteads. A score of families

ALFRED EICHENBAUM OK's IT

Alfred Eichenbaum, who operates the "Hobby House," at 225-15 Merrick Blvd., Laurelton, L. I., sent in this snapshot of Victor Miller's model Taylorcraft. "As a hobby dealer I consider this the finest piece of model building by a sixteen-year-old boy that I have ever seen," says Mr. Eichenbaum. His letter goes on to explain that every part of the plane can be measured with calipers and will be found perfectly accurate. The original model now occupies the place of honor in Mr. Eichenbaum's store. "May I recommend Victor for your Workbench award and Certificate of Merit?" asks Mr. Eichenbaum. "Just send it to him at his address, should you consider it worthy."

We do consider it worthy, and we're sending young Victor Miller a $3.00 Workbench award and a Certificate of Merit to his home at 222-14-131 Ave., Laurelton, L. I. We're also sending a Certificate of Merit to Mr. Eichenbaum for recognizing fine workmanship.

TODAY'S PATENTS WILL HELP TO SHAPE OUR LIVES AFTER VICTORY!

THINGS that men have dreamed of . . . and figured *might* be achieved ten, twenty years hence . . . are in the minds of inventors NOW . . . and will become realities when the war is won. Revolutionary developments in radio . . . the miracles of the electronic tube . . . will come into being, along with the host of those indispensable "little things" such as have in the past made fortunes for their originators. Today is the time to prepare for tomorrow!

VICTOR J. EVANS & CO. WILL HELP YOU PROTECT YOUR INVENTIONS!

For nearly a half century, this great firm of Registered Patent Attorneys has been helping men just like you. They offer advice on just how to go about getting a United States Patent . . . the valuable monopoly that gives you "exclusive right to make, use or sell" your invention. Professional inventors invariably secure their patents through a Registered Patent Attorney . . . follow their example . . . it's the surest, most successful way!

GET THESE **FREE BOOKS**

64 pages of facts, illustrating and describing 115 mechanical movements, step-by-step procedure on how to get your patent . . . and practical hints on how to market it. These books have set many inventors on the pathway to success in invention. Free offer also includes "Evidence of Invention" form.

NOW is the time!

When the war is won and manufacturers push and shove to get new peacetime products into the hands of an eager buying public, your invention may be more valuable than you ever dreamed possible. Use this "priority-time recess" to prepare and prosecute your patent *now* so it will be ready when the great day dawns!

SEND COUPON TODAY!

VICTOR J. **EVANS & Co.**

REGISTERED PATENT ATTYS.
Main Office, 750-C Merlin Bldg.
WASHINGTON, D. C.

Please send me your books, "Patent Protection" and "How to Sell an Invention"—also important "Evidence of Invention" form, without cost or obligation.

NAME .....

ADDRESS .....

PLACE AND STATE .....

ELECTRICAL BOOKS shipped FREE

10 BIG BOOKS

FOR EXAMINATION
MODERN ELECTRICITY INCLUDING RADIO AND REFRIGERATION

Here's great news for anybody interested in Electricity. NEW 18th. edition of Applied Electricity brought right down to date with NEW Electrical subjects fully covered, including Electrical Blue Print Reading. 10 big Volumes and all shipped **FREE** for examination.

New Edition For Beginners and Experts

over 3000 pages—hundreds of illustrations—the most complete work of its kind we have ever published. Dynamos, motors, power stations, wiring, radios, everything electrical explained so anyone can understand it.

BIG FIELD! Big Demand! Big Pay!

Men who understand electricity are urgently needed in thousands of War Production industries. Airplanes, ship building, arms plants, machine shops—practically every industry depends on electricity and men who know this subject make big money. Pleasant, fascinating work, easy to learn and do; learn with these books. Send coupon for a set for **FREE** examination and see for yourself.

SEND NOW — A year's consulting privileges with our engineers now given to all buyers of this famous Cyclopedia of Electricity.

AMERICAN TECHNICAL SOCIETY
Vocational Publishers since 1898

American Technical Society, Dept. E3320, Drexel at 58th St., Chicago

Send for 10 days' free use, 10 volume set of **New 18th Edition**, Applied Electricity, including a certificate entitling me to consulting privileges for one year. I will pay the delivery charges only on the books. If I wish I may return them in 10 days and owe you nothing, but if I keep them, I will send $2.00 after 10 days, then $3.00 a month until the total price of only $29.80 is paid.

NAME _____

ADDRESS _____

CITY _____ STATE _____

Please attach letter stating age, occupation and name and address of employer and give at least one business man as reference.

WAR BONDS AND STAMPS

FOR VICTORY

Short-Cut Mathematics
COMBINED WITH
Practical Mechanics Simplified

NEW 2-in-1 reading course! Now you can learn the speedy, simplified system of calculation used by draftsmen, engineers, accountants, "master minds" on the stage. Learn easy way to multiply 4 figures by 4 figures without using old-fashioned multiplication; add long columns of figures this lightning short-cut method. Learn horsepower, slide rule, micrometer, logarithms, wood measure, puzzles, etc., etc. Large illustrated volume complete with answers, only $1 postpaid. Satisfaction or refund. Amaze friends with your magic-like mental powers.

FREE Complete details ... mail coupon TODAY!

NELSON CO., 500 Sherman St., Dept. C-301, Chicago
Please send free details about "Short-Cut Mathematics and Practical Mechanics Simplified." No obligation.

Name _____

Address _____

CARTOON YOUR WAY TO SUCCESS!

DON'T COPY — LEARN TO ORIGINATE

RAYE BURNS will teach you HOW to CREATE ORIGINAL CARTOONS at home that you may SELL! Course contains 26 lessons and over 600 illustrations. All for only **$2.85**

Send name and address for free details.

RAYE BURNS SCHOOL, Dept. F, Box 1298, Cleveland, Ohio

STUDY ENGINEERING AT HOME

With A Chartered Educational Institution

Courses in **ENGINEERING:** Electrical, Civil, Mechanical, Drafting, Architectural, Steam, Aeronautical, Radio, Structural, Mining, Industrial, Highway, Petroleum, Marine, Chemical.

Courses in **ARTS AND SCIENCES:** Philosophy; Education; Letters; Public Health; Medical Jurisprudence; Psychology; Sociology; Physics; Chemistry; Geology; Pol. Science; Theology; Law; Business and Commerce; Accounting; Mathematics; Statistics; Agriculture.

McKinley-Roosevelt Incorporated. 4610-DC. Sheridan Road. Chicago

Know Your Arc Welding!

Bring yourself up-to-date on Arc Welding methods, procedures, techniques and equipment with this sensational 1942 manual. Hundreds of pages of illustrations and diagrams "show you how" . . . and the text tells you in clear, concise, style. For experts and beginners alike. It'll be worth a hundred times its cost to you.

$2.00 Postpaid

Write Today! HOBART Bros., Box SM-331, Troy, Ohio

Complete Manual and Ready-Reference Text. 516 pages 512 Illustrations ... Easy to read and understand.

Send for Your Copy Today! Once you look it over you'll want it always at your fingertips. Remember, it can make the best operator even better.

Ask about FREE enrollment in the HOBART Trade School. One of the finest in America.

5 Days FREE Inspection • Most Valuable Book on Welding ever published!

have banded together and are building rammed earth houses at far less cost than would have been incurred by conventional construction methods. The co-ops themselves are doing the ramming, under the consultant architectship of none other than Frank Lloyd Wright. The site for the project covers 120 acres in Detroit's suburbs, and plans call for the erection of 79 rammed earth houses, a community center and other accessory buildings. When this project proves successful, as it undoubtedly will, others won't be far behind.

All of which brings us to the fact that MI is helping pioneer development of *pise de terre* on this side of the Atlantic by publishing a series of articles on earth dwelling construction, including both the rammed type and adobe brick. You'll find the first of the series starting on page 104, and we know you'll be interested in reading it, whether

INSPIRED BY BURNELLI PLANE

Remember the flying tank-carrier described and illustrated in "Burnelli Did It First" in the June MI? Staff artist Reynold C. Anderson's vivid drawing of this great plane so impressed Roger Engel of 2025 East First Street, Brooklyn, N. Y., that he set to work building a model of it. The result, shown with him above, is "a swell flyer, has a good glide, but its endurance is a little short of what I expected. This can be blamed on the added weight of the flat body. I am making plans for a second design of this plane because of its success, however. The cost was $2.00 but it's worth even more to me because of the pleasure in making it."

The model has a 4' 8" wingspan, is 22 inches long, and has four propellers (two 9" props and two 5½" props as pushers). The body gives the plane extra lift and streamlines it, too, to a greater extent. The plane can be fitted with a retractable landing gear. It lands on its two rudders. Engel's imaginative enterprise and workmanship earn him a $3.00 check and a Certificate of Merit.

Free 7-Day Offer!

REMARKABLE ILLUSTRATED MANUAL

Shows exactly how to do any AUTO REPAIR JOB

USED BY U. S. ARMY

Warranted to Cover Every Repair Job on Every Car Built Since 1935!

Explains Every Repair Job on Every Model of All These Cars—1935 through 1942!

American	La Salle
—Bantam	Lincoln
Auburn	Lincoln
Austin	—Zephyr
Buick	Mercury
Cadillac	Nash
Chevrolet	Oldsmobile
Chrysler	Overland
Cord	Packard
De Soto	Pierce Arrow
Dodge	Plymouth
Ford	Pontiac
Graham	Reo
Hudson	Studebaker
Hupmobile	Terraplane
Lafayette	Willys

And major data needed to service 405 models of trucks

Nearly 200,000 Vital Facts on Every Phase of Tune-Up and Repair • Over 450 Charts, Tables • More than 900 Photos, Drawings, Diagrams • Over 600 Big Pages—Size 8¼ x 11 inches.

Published by MoToR, Leading Automotive Business Magazine, Desk 33, 572 Madison Ave., N.Y.

Any expert mechanic can tell you this is the ONE book needed to know everything necessary to keep those cars rolling today! Easy, step-by-step instructions anyone who can read can follow. Hundreds of photos, diagrams, drawings show exact how-to-do-it on every job for ALL automobiles built since 1935! Lots of shortcuts, replacement pointers. Saves time, money—even for the experts. Try it and see!

150 FACTORY GUIDES IN ONE!

Imagine a COMPLETE COLLECTION of ALL official shop procedure manuals, prepared by each car manufacturer's own engineers! That's what you GET in this book! Open the manual to the car you want—you'll find everything to show the *right* way to do the job.

AUTO MECHANICS, INSTRUCTORS AND STUDENTS:

This is the factory shop manual used by the U. S. Army, trade, technical, and vocational schools for training auto mechanics.

SEND NO MONEY

Simply fill out coupon below. Mail it today and a copy of MoToR's up-to-the-minute New Factory Shop Manual will be sent to you at once for 7 days Free Examination.

FREE 7-DAY TRIAL

MoToR BOOK DEPT., Desk 33, 572 Madison Ave., New York, N.Y.

Rush me MoToR's New Factory Shop Manual. If O.K. I will remit $1 in 7 days, and $1 monthly for 4 months, plus 35c shipping charge with final payment. ($5.35 in all.) Otherwise I will return book in 7 days. (Foreign price $6, cash with order.)

NAME_____ AGE_____

ADDRESS_____

CITY_____ STATE_____

OCCUPATION & EMPLOYER_____

☐ SAVE 35c! Check here and enclose $5.00 with coupon. We then pay 35c postage and packing costs. Same return privilege.

Make BIG MONEY AT HOME!

NEW Invention **Electroplates by BRUSH**

Now Plates CHROMIUM!

ALSO GOLD, SILVER, NICKEL, COPPER, ETC.

War Increases Demand—You Profit!

New, patented invention makes possible big earnings AT HOME. Replate auto-parts—worn articles in homes, stores, hotels, restaurants, etc., with durable, sparkling, new coat of metal—with stroke of brush. Easy, simple, quick. Genuine Gold, Silver, Nickel, Cadmium, etc. Everything furnished. Outfit complete, ready for use. No shop required. Clear from $2 to $5 an hour in lifetime business. Small investment starts you in business. Steady repeat. Machine can pay for itself in week. Send TODAY for FREE SAMPLE and illustrated BOOKLET how you can have a life income from a business of YOUR OWN built upon satisfied customers. Act at once!

WARNER ELECTRIC COMPANY
215 W. Ohio St., Chicago, Ill., Dept. 238

FREE BOOK & SAMPLE

WARNER ELECTRIC CO., 215 W. Ohio St., Chicago, Ill., Dept. 238
Gentlemen: Send me Free Sample and Illustrated Booklet.

Name_____

Address_____

City State

Inventions Wanted
Patented or Unpatented

If you have a sound, practical invention for sale, patented or unpatented, it can now be safely sold without patenting expense. Write for complete details, today!

CHARTERED INSTITUTE of AMERICAN INVENTORS
Dept. S, 631 Pa. Ave. N. W. Washington, D. C.

PATENTS
AND TRADE MARKS
C. A. SNOW & CO.

Registered Patent Attorneys Since 1875

Write for Free Book and "Certification of Invention" form

427 SNOW BUILDING, WASHINGTON, D.C.

DRAW for MONEY
Be An ARTIST!

Trained Artists Are Capable of Earning
$30 - $50 - $75 A WEEK

Use your spare time to prepare for a profitable Art career!

It's pleasant and interesting to study Art the W. S. A. way. **COMMERCIAL ART, ILLUSTRATING, CARTOONING**—all in ONE complete course. No previous Art experience necessary—hundreds have profited by our practical home study method since 1914. Write today for information in FREE BOOK. "Art for Pleasure & Profit"—tells all about our course, service—and commercial opportunities for you in Art. State age.

WASHINGTON SCHOOL OF ART
Studio 203 F, 1115-15th St., N. W.
Washington, D. C.

Quick! Get into DRAFTING now

Learn At Home From An Engineer

With industry working feverishly—the field for DRAFTSMEN is bigger than ever! Get into a better job with more pay and fascinating, pleasant work. I will train you at your home in your spare time until you are holding a better paying position as Draftsman. My practical training in drafting also includes a working course in Industrial Designing valuable on new products, improving, restyling and modernizing—all extremely important and profitable to draftsmen. Write for full illustrated details and booklet. Give your age.

All working tools, including drawing table, sent to you at once—furnished free with course.

ENGINEER DOBE, Division 4743, Libertyville, Illinois

FREE! FOR THE ASKING

The famous MI Blueprint Booklet, handy and complete, is yours for the asking. It contains full descriptions of more than thirty blueprints of interest to the handy man. The booklet was prepared by the editors of MECHANIX ILLUSTRATED.

Simply write, "Please send me a MECHANIX ILLUSTRATED Blueprint Booklet," and give your name and address. A three-cent stamp is required to cover the cost of mailing. The booklet will be sent to you without any obligation whatever. Mail letter to:

BLUEPRINT DEPARTMENT
MECHANIX ILLUSTRATED
1501 BROADWAY NEW YORK CITY

Do you want

..to go to College?

..or to enter a Profession?

(Such as Accounting, Architecture, Nursing, Dentistry, Teaching, Social Work, Osteopathy, Beauty Culture, Optometry, Embalming, Chiropody, Law, Medicine, etc.)

..or get an Office Position?

To get anywhere, you practically MUST finish High School FIRST. You can complete our simplified High School Course in SPARE time at home, as FAST as your time and abilities permit. Equivalent to resident school work—prepares you for college, pre-professional examinations, business, industry. Standard texts furnished. Diploma. Credit for H.S. subjects already completed. Single subjects if desired. Low tuition, easy terms. American School, Chicago, est. 1897—endorsed by educators. Finish your high school education NOW. Write TODAY!

High School Course at Home — Many Finish in 2 Years

American School, Dept. H328, Drexel Ave. at 58th St., Chicago, Ill.

Gentlemen: Send me FREE information covering special training in subjects checked below. No obligation on my part.

- ☐ High School Course
- ☐ Cost Accounting for Manufacturing
- ☐ Architecture and Building
- ☐ Automotive Engineering
- ☐ Business Management
- ☐ Electrical Engineering
- ☐ Elec. and Gas Refrigeration
- ☐ Air Conditioning
- ☐ Diesel Engineering
- ☐ Drafting and Design for Men and Women
- ☐ Plastics
- ☐ Private Secretary
- ☐ Mechanical Engineering
- ☐ Aviation ☐ Radio
- ☐ Salesmanship
- ☐ Shipbuilding

Name .....

Address .....

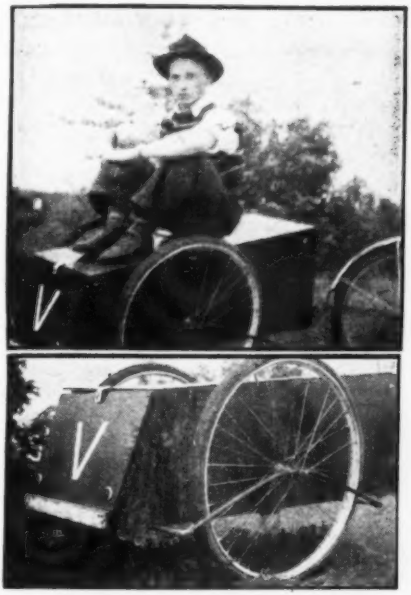
you ever build an earth house or not. We believe we've compiled the most complete information yet available on the subject, though you'll soon be reading about *pise* all over the place. Be glad you read MI though—you get it firstest and mostest!

Oops!

ONE of those things occurred in our January issue and we want to correct it now. You will remember the beautiful kodachrome cover showing a P-39 fighter pilot at the controls of his plane which we ran on the January cover of MECHANIX ILLUSTRATED. Inadvertently, the kodachrome was credited to Rudy Arnold, when, as a matter of fact, it was taken by Atlas Photos. We're sorry.

While we're on the subject, we want to expand upon a credit which should properly have been given in connection with a picture on page 50 of the same issue. That drawing showed our artist's conception of a sectional freight-carrying airplane. Our author, Mr. Cooley, mentioned in his article

BICYCLE TRAILER FOR MILK



Donald C. Beckett, 15, of Tamworth, Ont., Canada, built this sturdy bike trailer—it'll hold 300 lbs., and the ends let down so that long objects can be accommodated—during his spare time last winter with the help of a friend, Edward Irving of Nipawin, Sask. Beckett used to live there and needed the trailer for delivery work at a creamery.

The trailer's framework is 1x2-in. fir strips and is covered with veneer for the sake of lightness. The lid is center-hinged. "Though a little hard to start rolling with a big load, it pulls and handles easily," Beckett reports. For this excellent workshop solution to a need for help in his work, Beckett is awarded $3.00 and a Certificate of Merit.

INVENTORS This BOOK and INVENTION RECORD (Cost You Nothing) FREE BOOK

HOW TO PROTECT, FINANCE and SELL YOUR INVENTION

Our FREE BOOK and other literature available to our clients—gives you complete details on how to "ready" your invention for money-making. It tells you how others did it—who they went to for finances—how they arranged partnerships—how they made contacts with manufacturers—how they dictated royalty arrangements—how much money they made—how you can find a market. Our new FREE BOOK discloses sources of quick revenue if your invention is patentable and saleable with profit possibilities.

THE FIRST STEP

The first step in getting your invention ready for market is to make a dated record of it on our "Invention Record" Form. This Form properly filled out and witnessed will be invaluable to you later in establishing the date of your invention should need for such evidence arise. We will be glad to send you our "Invention Record" and have it witnessed in this office when you return it with disclosure of your device. This service costs you nothing—and it immediately puts you on record as the originator of your device.

Protect Your Invention NOW!

We have many letters in our files from manufacturers requesting inventions. Today's demand for new devices is tremendous—added to by emergency needs. Protect your invention now with a U. S. Patent. By acting promptly you may prevent another inventor getting in ahead of you at the Patent Office here in Washington. The first step is to make a sketch and description of your invention on our "Invention Record," have it witnessed and mail it to us. We will then make a Search of the U. S. Patent Office files to ascertain whether we can get patent protection for you. This is a step you should make NOW—before another steps in ahead of you and walks away with a patent.

COUPON TODAY!

McMORROW & BERMAN
REGISTERED PATENT ATTORNEYS BEFORE U.S. PATENT OFFICE
139-B Albee Building
Washington, D. C.

Send me your NEW FREE Book "How To Protect, Finance and Sell Your Invention" and specially prepared "Invention Record" form at once. I understand that this request does not obligate me.

NAME _____

ADDRESS _____

CITY _____ STATE _____
Write or Print Name Clearly

AN INFANT INDUSTRY SUDDENLY MATURED

PLASTICS

Get In at the Start—and Grow

Plastics is a new industry which the nation's war needs is forcing to quick maturity. Already Plastics are indispensable in practically every branch of the Service—Aircraft, Ordnance, Chemical, Marine, Signal Corps, etc. Opportunities? Nearly everything, from homes to clothing, from gadgets to tools, will be affected by Plastics.

Spare Time Training Now Ready

The time to get started is *now*. You can prepare at home, in your spare time, to take your place in an infant industry that even now is leaping into prominence. A new, practical training plan is now ready to help you realize your ambitions and build your future security. Act now. Don't delay. Mail this coupon today.

AMERICAN SCHOOL, Dept. P328,
Drexel Ave. at 58th St., Chicago, Ill.
Send me FREE information covering special training in subjects checked below. No obligation on my part.

☐ Plastics
☐ Electrical Engineering
☐ Drafting and Design for Men and Women
☐ Diesel Engineering
☐ Mechanical Engineering
☐ Aviation ☐ Radio
☐ Cost Accounting for Manufacturing
☐ Automotive Engineering
☐ Architecture & Building
☐ Shipbuilding
☐ Business Management
☐ High School Course

Name.....

Address.....

LAW...

STUDY AT HOME Legally trained men win higher positions and bigger success in business and public life. Greater opportunities now than ever before. **More Ability: More Prestige: More Money** We guide you step by step. You can train at home during spare time. Degree of LL.B. We furnish all text material, including 14-volume Law Library. Low cost, easy terms. Get our valuable 48-page "Law Training for Leadership and "Evidence" books FREE. Send for them NOW.

LaSalle Extension University Dept. 3492-L Chicago
A Correspondence Institution

Learn Profitable Profession in 90 days at Home

Earnings of Men and Women in the fascinating profession of Swedish Massage run as high as $60 to $70 per week but many prefer to open their own offices. Large incomes from Doctors, hospitals, sanitariums and private patients come to those who qualify through our training. The Army and Navy need hundreds trained in massage. Write for Anatomy Charts and booklet —They're FREE.

THE College of Swedish Massage
100 E. Ohio St., Dept. 358, Chicago

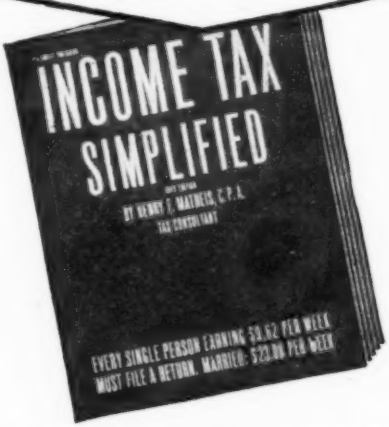
GRAY HAIR VITAMIN

NOW $1.95 Pay No More

No dyes—No drugs—Hair grew out in Natural Color in almost nine out of ten test cases just adding Calcium Pantothenate Vitamin to regular diet.

WHY PAY $3.50 TO $5.00 for the famous "Gray Hair Vitamin" when you can buy 100—10 mg. tablets of genuine Calcium Pantothenate—same as used in National tests—by mail for $1.95. SEND NO MONEY. Just send name and address on penny postcard. We will ship 100—10 mg. tablets C. O. D. for $1.95 plus few cents postage. If not completely satisfied with quality return package within ten days for immediate refund of your money.
Address Lilco Products Co., 2017 S. Michigan, Dept. 453, Chicago

YOU MUST MAKE AN INCOME TAX RETURN


INCOME TAX
SIMPLIFIED
BY HENRY F. MATHEIS, C.P.A.
TAX CONSULTANT
EVERY SINGLE PERSON EARNING $9.62 PER WEEK
MUST FILE A RETURN. MARRIED: $23.08 PER WEEK

IF YOU are SINGLE and earned as much as $9.62 a week, or MARRIED and earned as much as $23.08 a week, during 1942, *you must make out an income tax return!* Now, more than ever, you need a *simple*, easily understandable guide to follow in making out that return.

If you are careless in making out your return, it may cost you many dollars! If you don't understand the form and the laws *clearly*, you may find yourself in serious trouble!

INCOME TAX SIMPLIFIED, written by the noted authority, Henry Matheis, has gained a wide reputation for being the MOST CLEARLY AND SIMPLY WRITTEN book in its field. It's written in the words of the man in the street—it avoids all legalistic phraseology. You don't need to consult a lawyer in order to understand it.

And, INCOME TAX SIMPLIFIED has a copyrighted feature which will not be found elsewhere—a table which will enable you to tell at a glance whether you can save money by using the new government form 1040A. This feature alone can save you a great deal of money!

INCOME TAX SIMPLIFIED contains a concise explanation of the new Victory Tax, as well as many other features. Don't risk getting into trouble because you don't clearly understand the law! Don't risk paying more than you should because you don't take all the deductions due you!

Get INCOME TAX SIMPLIFIED from your newsstand or book dealer today, or fill out the coupon below. Time is short!

CUT OUT AND MAIL TODAY!

Fawcett Publications, Inc. MI-3
Greenwich, Conn.

Please send me, postpaid, a copy of INCOME TAX SIMPLIFIED. Enclosed find 25 cents in check, money order, or stamps. (Wrap coins in paper before placing in envelopes.)

Name .....

Address .....

City ..... State .....

(CANADIAN ORDERS NOT ACCEPTED)

Editor's Workbench Chips

that this design for sectional freight planes had been originated by Mr. Harlan D. Fowler, of the Fowler Aircraft Co. We should have called attention to this fact in the caption under the drawing, also. Mr. Fowler is doing extensive development along this line, and we are sure MI readers will be interested to hear that this is one of the wonders of "A World You Never Knew" which they will probably be seeing in the not too distant future.

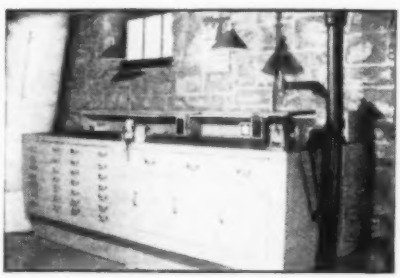
What, More Bicycles?

YES, more bicycles, but the average American seems to have such a tremendous interest in these fundamental vehicles (possibly childhood hangovers) that we can't help bringing up the subject again. Besides, when you consider what gives with the gasoline supply now, and things almost certain to get worse before they get better —well, which would you rather have, a bike or fallen arches?

Anyway, back in May, 1942, we told you to go out and get a second-hand bike before they were all gone, and we showed you how to fix it up as good as new. Then, in July, 1942, we told you how to install a small motor in your bike so you could get the most from what gas was available. Many of you looked ahead a bit and did all those things, but for those of you who didn't we still have a word of cheer. MI to the rescue again!

Of course, you can't buy any kind of a bike now, or a motor either, for that matter, unless you are a defense worker, BUT—have you ever thought of building yourself a bike? Well, you can; quite easily too. If you doubt this, just turn to page 108 and take a look. Then get out the tools

[*Continued on page* 33]



This excellent workbench is the work of Raymond A. Meyer, of 5536 Walsh Street, St. Louis, Missouri. Three large drawers and fourteen shallow ones provide ample room for the tools, keeping them handy and free from dust. Made in two 4½-foot sections for easy moving, the bench is extremely rugged. Framework is of 2 x 4 and 2 x 8 lumber, and covering is plywood on top and sides. A neat trick is the installation of the jig saw motor inside the bench, to leave more clear space on the bench top. The lower portion of the bench front is recessed so the worker's feet can project beneath it and permit him to stand close to the bench. This snapshot brings Mr. Meyer a $3.00 Workbench award and a Certificate of Merit.

MEN *whether you are* **16 or 50**

YOU ARE VITALLY NEEDED IN OUR NATIONAL VICTORY PROGRAM

Trained Electrical men are needed now. It's not how young you are, or how old you are. The question is—have you the training to hold a particular job that must be filled.

Learn ELECTRICITY IN 12 WEEKS

ON REAL MOTORS, GENERATORS, ETC.

I'll Finance Your Training

Electricity is the mighty power behind our Victory Program. Trained Electrical men are needed in the armed forces and in industry. YOU are needed—whether you are in the **draft or deferred.** PREPARE FOR YOUR PLACE this amazingly easy way. **"Learn By Doing" in 12 weeks.** You don't need much money—**I'll finance your training.**

"Learn-By-Doing"

Coyne training is EASY, PRACTICAL! Here **you can** train in 12 weeks—not by books or lessons, but **on real actual electrical machinery and apparatus. You "Learn by Doing"** on real motors, generators, switchboards, and all types of practical electrical equipment. **Get your training first**—then **pay for it in easy monthly payments after your training period is over.** If you are short of money to pay for living expenses while you are in school, we'll get you a part-time job so you can **"earn while you learn".** After you graduate, we give you LIFETIME EMPLOYMENT SERVICE.

Right now I'm including an **extra 4 weeks' Radio Course** at no extra tuition cost.

Get the Facts

This school is 43 years old—Coyne training is tested and proven. Mail the coupon and let me send you **the big,** free Coyne Book and my complete story about **how I help you get the training you need for a good-pay electrical job.** This does not obligate you. No salesmen will call. So act at once. Just mail coupon.

H. C. LEWIS, President

COYNE ELECTRICAL SCHOOL

500 So. Paulina St., Dept. 33-53, Chicago, Ill.

H. C. LEWIS, President
COYNE ELECTRICAL SCHOOL
500 S. Paulina Street, Dept. 33-53, Chicago, Ill.

Send me your **Free Book** and **tell me about your plans to help me.**

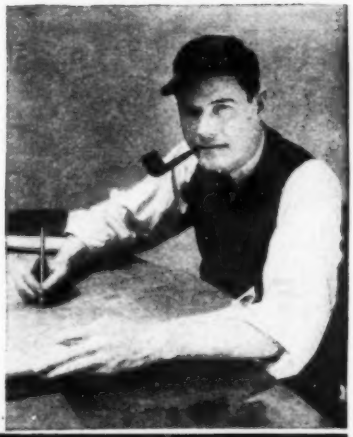
NAME.....

ADDRESS.....

CITY STATE

Here I am At Work

Making Good Money at a big Aircraft Plant thanks to this



Free TRIAL LESSON IN DRAFTING

THE KEY TO ALL WAR AND PEACETIME INDUSTRY

Yes, this free lesson proved that drafting is easy, mighty interesting work . . . convinced me I didn't need special talent to get into this well-paid profession . . . proved beyond a doubt that Drafting by the fascinating C.T.C. method can be mastered easily AT HOME IN SPARE TIME.

So I enrolled. I learned Drafting *at home*,—in my spare time. Today I feel secure in my job as an Aircraft Draftsman. The War Production Program has increased the demand for Aircraft Draftsmen, Machine Draftsmen, Architectural Draftsmen, Electrical Draftsmen and Structural Draftsmen. For Draftsmen always come first on any new project in manufacturing and industry . . . and in those new Aircraft plants and Shipbuilding yards, Draftsmen can't be replaced with machines. What's more, I'm slated for promotion and more pay—but if I wish, I can be independent . . . go into business. And, as a draftsman, I have a peace time future as well as a good job now.

Here's a tip: Mail the coupon or drop a card for the free trial lesson. Do this today—and drafting will take care of you tomorrow.

YOU GET THIS COMPLETE DRAWING OUTFIT

Without a penny extra. All the tools you need, including drawing table. With this outfit you can put your ideas on paper quickly and with accuracy. With training, you're all set to master drafting in months—not years—at home, and you can use these very same instruments as a draftsman later.

LEARN in Spare Time — At Home!
(or at the College in Chicago)

A few hours of pleasant home study every week—that's all. NO interference with your present job! With Chicago Tech's help, you train yourself step by step. This tested method,—developed over 39 years of C.T.C. progress,—will fit you for a job in months—just the kind of a job you've wanted.

TRAIN FOR PROMOTION—and More Money

ALL WAGES and salaries have been fixed by new Federal Law. The only manner in which an employee can get more money is through increased responsibilities and more important duties. Get this: the only way in which your employer can pay you more money by law—is through promotion—by giving you more responsibilities. And the best manner to secure promotion is through training yourself to be more valuable.

To prove to you how easy it is to learn Drafting by the Chicago Tech method, we'll send you a Trial Lesson FREE. No charge for this lesson either now or later. Send a post card or the coupon now for FREE TRIAL LESSON in Drafting.

39 Year Old College in Modern Well Equipped Home

Chicago Technical College has graduated hundreds of successful draftsmen, engineers and technicians since its founding nearly 40 years ago. During that time, its educational standards and instruction have been of the highest. Chicago Technical College occupies a unique place in the educational world in that it offers both residential and Home Study courses. In its new home on Michigan Avenue in Chicago the College has modern well-equipped shops, laboratories and drafting rooms where hundreds are in training for promotion in its day and evening classes. You can get this same high grade training in Drafting **right in your own home.** Keep your present job and train for a better one. **Mail the Coupon today!**

WOMEN!

Girls and women are also taking good positions in drafting rooms at same high base pay as men. Find out if you are qualified. Send the Coupon.

MAIL THIS COUPON

CHICAGO TECHNICAL COLLEGE

C-267 Tech Bldg., 2000 So. Michigan Ave., Chicago, Ill.

Please send me Free Trial Lesson in DRAFTING showing how to learn at home by C.T.C. plan for a good job in aircraft and other war industries. No obligation, of course.

Name .....

Address .....

City ..... State .....

Occupation ..... Age .....

CHICAGO TECHNICAL COLLEGE

Training Division for War Production

C-267 Tech Bldg. 2000 So. Michigan Avenue, Chicago, Illinois

MONEYMAKERS Classified MONEYSAVERS

20¢ a Word

PROFITABLE SIDELINES • HOBBIES • SPECIAL BARGAIN BUYS

To get your share of the business from our MAY ISSUE, your ad with remittance must be in our office MARCH THE THIRD, Mail to MECHANIX ILLUSTRATED • 1501 Broadway • New York

ALL MECHANIX ILLUSTRATED CLASSIFIED ADS ARE GUARANTEED

ADVERTISING SERVICE & AGENCIES

ADVERTISE: 24 WORDS, 149 Newspapers $6.50. Lists Free. Advertising Bureau, 4515-B Cottage Grove, Chicago.

PERSUASIVE ADVERTISING Copy—Inexpensive! Information Free. Fisher, 1244 Hayden, Cleveland.

AGENTS WANTED

BIGGEST MONEY making line in country for retail stores and agents—insignia service banners, pillow tops, pennants, military jewelry for all services—Hitler and Hitler-Hirohito rat pin cushions—Musso and Hitler ash trays—many others—lowest wholesale prices—samples $5.00 postpaid—guaranteed value over $12.00. Clover Novelty Co., Dept-31, Hollis, New York.

1,000 BARGAINS—LADIES' Aprons 12¾c, Hose 8c, Shirts 70c, Turkish Towels 10c, Aspirin 2c dozen, Shaving Soap 3c, Razor Blades 70c hundred, hundreds other real bargains. Operate from Auto, Home or Store. Make Big Profits. Postcard brings free illustrated catalog of 2,000 fast sellers. Reliable Jobbers, 930 Roosevelt, Dept. C-3, Chicago, Illinois.

ADVERTISING BOOK matches. America's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches. Complete cut catalog. 17 color combinations makes selling easy. Commission in advance. Superior Match Company, 7530 Greenwood, Dept. F-3, Chicago.

I WILL give you $5.00 worth full size packages foods, groceries, soap, etc. Free if you agree to show friends and others. Amazing spare time money making opportunity. Write Zanol, 8808 Monmouth, Cincinnati, Ohio.

SCHOOL SENIORS—Sell Graduation Name Cards to Classmates. America's largest, fastest selling display. Highest Commissions. Your Cards Free. Craftcards, Box 235-AG, Pittsburgh, Pennsylvania.

MAKE MONEY applying initials on automobiles. Also, sideline salesmen for short run decal name plates. "Raico," 1483 Washington, Boston, Massachusetts.

LICK AFTER-WAR layoffs. Start own business; home, office. Booklet describing "Collection of 127 Tested Plans" free. Elite Co., 214-G Grand St., New York.

SHAVE WITH almost feather-like touch; attachment for any 2-edge safety; agents demonstrating outfit 10c. Adjustrite, 35M North 9th, Columbus, Ohio.

MAGIC SHOPPING Bag. Sells like wild. Magically turns purse into roomy shopping bag. Handy, compact. Samples sent on trial. Kristee 126, Akron, Ohio.

SOMETHING NEW and Different. Silk Screened Glass Calendars. Sample 25c. Desk Style Extra. Kirstein, 89 Westminster, Rochester, New York

MEN'S SHOES 14c. Hats 12c, Pants 28c, Dresses 10c, Winter Coats 50c, Fall Coats 35c. Bargain catalog Free. Portnoy, 566-T Roosevelt, Chicago.

AGENTS: GUARANTEED Merchandise. Credit to reliable people. Hudson Service, 1472 Broadway, New York.

LUMINOUS PAINT—Profitable 50c Seller. Details. Ward, 97A, Saybrook, Connecticut.

PLAYING CARD game. 250% profit. Sample game 25c. Box 842, Denver, Colorado.

FOR QUICK Cash without canvassing, Write, Terrill, B-6, Bogard, Missouri.

AUTHORS' SERVICE

NEW WRITERS wanted to re-write ideas in papers, magazines, books. Splendid opportunity to "break into" profitable writing field. Rush postcard for Free Details. Comfort Writer's Service, Dept. FL-140, St. Louis, Missouri.

HOBBYISTS, BEGINNING Writers—Send Dime Stamped envelope for Free Membership and Guarantee of Amazing Success. Feature Writers Union, 215 Faraday, Peoria, Illinois.

AVIATION

BUILD AND fly your own motorcycle powered monoplane, home. Easy, cheap. Tested plans, guaranteed, $1.00. Aerotech, Dearborn, Michigan.

BABY CHICKS

COLONIAL CHICKS. World's largest production means lowest prices. Leading breeds. Catalog Free. Colonial Poultry Farms, Pleasant Hill, Missouri.

100 CHICKS $5.75, 200 $11.00 Postpaid. Empire Hatchery, Seward, New York.

BARGAINS

MEN'S REVERSIBLE Neckties. Ward's Novelty Shop, Box 542, Albany, New York.

BUSINESS OPPORTUNITIES

PLASTEX INDUSTRY needs manufacturers on small scale and for big production of Art Goods and Novelties in Plastex and marble imitation. Cheaply and easily made in our guaranteed rubber moulds. We are now placing big Chain Store orders with Manufacturers. Interesting booklet mailed free. Plastex Industries, Dept. R, 1085 Washington Ave., New York.

BRUSH PLATING Outfits connect to a battery, no tanks necessary. Almost as simple as painting. Your opportunity to make good income plating autoparts, bathroom fixtures, reflectors, mirrors. Get free proof and particulars that put you in a paying business of your own. Gunmetal Co., Ave. A., Decatur, Illinois.

HOMEWORKERS—$50.00, $75.00, $100.00 Weekly. Castwood gifts, plaques, novelties. We furnish material, molds, instructions. Sample woodcut bookends, mold model with illustrated molding circular, catalogue new flexible molds $1.00 postpaid. Castwood Products, 2110NW, Lawrence, Chicago.

MECHANICALLY INCLINED Men—Own and operate general Appliance Repair shop. Complete, illustrated course shows you how. Welding, Refrigeration, Motor Repairs, How To Get Business, etc., all phases covered. Free literature. Christy Supply, Dept. 225, 2835 N. Central Ave., Chicago.

SHOES LOOK New. Amazing "Nu-coat" polish hides spots and scuffs. Forty colors. Simple finger demonstration. Quick sales everywhere. Agent-dealer's full size samples and color card 50c. Sunbeam Products, Inc., 138 Main St., Toledo Ohio.

MAIL ORDER Business Course shows you how to make money, spare or fulltime. Teaches professional mail order technique—not penny-catching schemes. Free details Nelson Company, 500 Sherman, Dept. C-401 Chicago.

SUCCESS SAYS hello to you! Your own boss, your own business, right at home! Amazing new mail order course shows you, tiny capital starts you. Be smart; get free details! Write Century, 152 W. 42nd Street, New York.

SELL OUR latest exclusive books on instruction by mail. Publisher furnishes snappy circulars. No bookstore competition. Bigger Profits. Rush name! Financial Education, 437 Commonwealth Bldg., Denver, Colorado.

DON'T BE satisfied with a few orders. Let me help you build up a real Mailorder Business. Every day lost lessens your profits. So write me today. K. Burkhart, 226 West 78 St., New York.

CAPITAL SEEKERS—Interested in raising $25,000 or more for a legitimate project should write to Amster Leonard, Fox Theater Bldg., Detroit, Michigan.

FREE—200 CLEVER mailorder, homework, local business offers—all snappy moneymakers. Lewis Co., 828-O Carpenter, Oak Park, Illinois.

"VARIOUS OPPORTUNITY Catalog." Opportunities galore. Nationally advertised. Copy 10c. Post Office Box 1735, San Diego, California.

START A home business in spare time. Make extra money. Experience unnecessary. Literature free. Dunbar, New Brunswick, New Jersey.

BE SUCCESSFUL—Operate own business; home, office. 127 Tested Plans. Particulars free. General Sales, 149-C East 161th, New York.

"HOW TO Make Simple Molds and Plaster Plaques." No rubber required! Booklet 25c. Plastercraft, 1406 E. 43rd St., Cleveland, Ohio.

SWISS MUSIC Box Works—$1.85 to $2.25. Suitable for many novelties. Mermod Manufacturers, 147 West 46th Street, New York.

START OWN Business—home, office; booklet describing "127 Business Plans" free. Elite Co., 214-G Grand Street, New York.

MOLD-MAKING, PLASTER Casting. Moneymaking Home Business. Literature free. Kemixal, Parkridge, Illinois.

NATION-WIDE OFFERS, Magazine. Usable Merchandise, Quarter Value, Dime. George Gates, Paragould, Arkansas.

WEBER TYPEWRITER Mechanics School. Simplified homestudy-repairing increasing. Canton, Ohio.

INTERESTED IN real Plastics? Send Stamped Envelope. Box 498, Gainesville, Texas.

MONEY MAKING Business starter, circular free. Wayne Products, Pleasantville, New Jersey.

MAKE MONEY renting Amidon Metal Scaffolds, Fifth Street, Elyria, Ohio.

BUSINESS SERVICE

LET ME look up anything you want to know, in Patent Office, Congressional Library, etc. Send Dollar with inquiry. John Crehore, Box 2329, Washington, D. C.

ANY QUESTION answered. Where? Why? How? What? Any subject. Simple ones, three day service, $1. Researcher, 4107A Osceola, Chicago.

CARTOONING, SIGNPAINTING, DRAWING AIDS

LEARN ARTISTIC Lettering. Surprise awaits you. Unique lettering examples free postpaid. Address, Thompson School, Box 872MI, Pontiac, Michigan.

EARN MONEY evenings, copying and duplicating comic cartoons for advertisers. 3X-Service, Argyle, Wisconsin.

CHEMICALS & SUPPLIES

WINN'S NEW Idea Home Laboratory Chemical Kits and apparatus outfits for Home Experimenting. Send 5c for literature and retail supply catalogue. J. H. Winn Co., Dept. 712, 134 W. 23rd St., New York.

EDUCATIONAL & INSTRUCTION

PSYCHOLOGY TEACHES about mind. Bio-Psychology teaches about power of mind over body. Why not learn to use powers of your subconscious mind? Study. Broaden your education. Correspondence course. Invest in yourself. What other investment can be more profitable? Gratuitous information. Dept. M, Taylor School of Bio-Psychology, Chattanooga, Tennessee.

FREE—A complete I.C.S. lesson pamphlet on Blue Print Reading! Unusual money-making opportunities in this booming field today. Experience, first-hand, the thrill and satisfaction of mastering a first step to success. International Correspondence Schools, Box 2319, Scranton, Pennsylvania.

GOOD "USED" educational books on all subjects bought, sold, rented, exchanged. Satisfaction guaranteed. Complete details and 64-page illustrated bargain catalog Free. Write Nelson Company, 500 Sherman, Dept. C-259, Chicago.

CLINICAL LABORATORY Technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 973-A, Austin, Texas.

PRACTICAL SEMI-TECHNICAL Home Study Books—fully illustrated. Many Subjects. Bargain catalogue free. Lumco, Kimball, Nebraska.

USED CORRESPONDENCE Courses and Technical Books Bought, Sold, Rented. Catalog Free. Educational Exchange, Henagar, Alabama.

DRAFTING COURSE $1 complete! Trigonometry $1. Slide Rule $1. Inquire Giles, Dept. M-3, 1326 Myers, Burbank, California.

UNUSUAL BARGAINS in Books. Write your Wants. Catalog Free. Royal Service, Box 20, Station "T," Brooklyn, New York.

WRITE FOR my Mailorder Facts today. No postcards, please. K. Burkhart, 226 West 78 St., New York, New York.

RENT LATEST technical books. Lowest rates—catalogue free. Merritt Co., Box 655, Springfield, Ohio.

FREE ILLUSTRATED lesson handwriting analysis. Examination free. Donalson, Linn Creek, Missouri.

HOME STUDY Course. Drugless Therapy. Free Literature. Inst. of Drugless Therapy, Tama, Iowa.

FOR THE HOME

BEAUTIFUL. DURABLE. Service Flag on plywood plaque. Army, Navy, Marines, Coast Guard, Air Forces. 65c postpaid. 25 Asst. model plane insignias, 25c. Artcraft Shop, 7140MI, Addison, Chicago.

UPHOLSTERING SUPPLIES, list free. Reupholster your own furniture and save. Tricks of the Trade makes it easy. $1.00. Wilson Supplies, 294 Quinnipiac Ave., New Haven, Connecticut.

FORMULAS, PLANS

AUTHENTIC FORMULARY 924 pages (illustrated). 10,000 Moneymaking formulas, recipes, instructions, substitutes. $1.75 postpaid or C.O.D. (Foreign $2.10.) Catalog 3c. Adams & Brown, Chestnut Hill, Massachusetts.

REAL MANUFACTURING formulas. Lists free. W. Cummings, Chemist, Gordon Ave., Syracuse, New York.

MAKE IMITATION Vanilla, 20c gallon. Send $1.00. McDaniel, 939 East Euclid, Detroit.

FORMULAS—ALL Kinds. Moneymakers Catalog Free. Kemico, 67, Parkridge, Illinois.

3,000 FORMULAS. MAKE Products, Sell. Schuth, Box 489, Danville, Illinois.

HELP WANTED—MALE OR FEMALE

WRITE FOR Free Fabric Samples amazing stainproof tablecloths. Clean with damp cloth. Require no ironing. Beautiful patterns. Look expensive long wearing, low priced. Commissions big. Also complete dress line. Melville Company, Dept. 3568, Cincinnati, Ohio.

CALL ON Friends with Greeting Card Assortments; Easter, Birthday, other occasions. Personal Stationery, Gift Wrappings. Big profits. Experience unnecessary. Samples on approval. Wallace Brown, 225 Fifth Avenue, Dept. U-86, New York.

MAILING LISTS

LIVE WOMEN'S names from rural routes, small towns, 500—$1.00. Campbell, Rte. 3, Sherwood, Oregon.

MONEYMAKING OPPORTUNITIES

IF YOU want to make real money in the Mailorder Field, get the facts from a true expert. Find out where to get active prospects. And make these people buy from you. Curiosity-Seekers, stay away. But if you're sincerely interested, just drop me a line for information. K. Burkhart, 226 West 78 St., New York, New York.

SCHOOL SENIORS—Sell America's most beautiful, distinctive Graduation Name Cards. Positively highest commission. Lowest Prices. Free sample kit. Printcraft, 1423 E. Elm Street, Scranton, Pennsylvania.

"MAIL ORDER Flashes" 25c. The $1 book of tips, plans, schemes that may spell financial success for you. Arthur Lifshin, 204 Washington Avenue, Chelsea, Massachusetts.

MAIL ORDER Business. Course In Modern Mail Order Methods. Learn How Successful Men Sell By Mail. Free Details. J. W. Fors, 4530 Chestnut, Kansas City, Missouri.

"MONEY BY Mail" brings proven, tested money makers to start your own business, sample copy 10c. Globe Cover Service, 707—25th St., Oakland, California.

UNLIMITED NEW opportunities now open. Spare-full time home businesses. We show you. Profitable Enterprises, Box M, Cobleskill, New York.

ESTABLISH HIGHLY profitable home mail order business. New Plan. Details Free! Martin, 2417-I Jefferson Ave., St. Albans, West Virginia.

YOUR NAME printed in 10,000 "Big Mail" directories 25c. Checking copies sent. Arlesse's, 15881 Log Cabin, Detroit, Michigan.

SELL—NEW Service Flag Stamps, Enormous demand. Samples, Particulars Free. Gold Press, 5017-M Cermak, Cicero, Illinois.

TIRED OF Working? Mail of opportunities, just 5c. Yankee Mail-Service, 107 North Third Street, Duquesne, Pennsylvania.

DON'T BUY razor blades until you get our low wholesale prices. Write Tharp, 914 Lexington, Cumberland, Maryland.

GIGANTIC MAILS, Opportunities, Magazines, Premiums, 25c. Thomas, 2019M Walnut, Allentown, Pennsylvania.

EARN MONEY evenings, copying and duplicating comic cartoons for advertisers. 3X-Service, Argyle, Wisconsin.

GIANT MAIL of Extra Cash Ideas, plus magazine, all for 10c. Distributers, 730 West Gift, Peoria, Illinois.

5 MOST READ Mail Order Magazines 20c. Armand Cartier, 695P North, Pittsfield, Massachusetts.

MAKE EXTRA Money. Stamp brings particulars. Mullen, M Box 514, Atlantic City, New Jersey.

RED-HOT LEGITIMATE ways to make money fast. We-Ta-Ro, Franklin, Pennsylvania.

10c BRINGS PACKET Moneymaking Magazines. Jones, 1210M Dudley, Utica, New York.

5 DIFFERENT MAIL Order Magazines Ten Cents. Loren Hollenberg, Roseville, Illinois.

PROFITABLE OCCUPATIONS

$40.00 WEEKLY, MADE growing mushrooms. Fresh, Dried. Dominion Patent #31583. Free Spawn. North American, 109M Yonge, Toronto, Canada.

$5000 FROM HALF Acre! Growing Ginseng. Seed, contract supplied. Particulars 10c. Associated Growers, Dept. 9, St. Norbert, Manitoba.

MONEY RAISING Rabbits. Investigate. Folder 10c. H. Close, Tiffin, Ohio.

RADIO SUPPLIES & INSTRUCTION

RADIO COMMUNICATIONS courses qualifying for all Federal licenses. Home study and resident courses. American Radio Institute, 1123 Broadway, New York, New York.

SALESMEN WANTED

JAPANESE HUNTING License, Size 8x10, Red, White and Blue. Sample 10c. Harvey, 2911 Telegraph, Oakland, California.

TREASURE FINDER

MT-SCOPE METAL Locator Fully Guaranteed and unsurpassed in efficiency. Time payment plan, trade-in and accessories. Free Literature. Fisher Research Laboratory, Palo Alto, California.

SEEK BURIED Treasure. Methods, devices, mysteries explained. Circulars free. Century Press, Box 151F, Glen Ellyn, Illinois.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING

THE BIG "300" package—200 letterheads 6x9 and 100 envelopes—prepaid $1.00. Ray Specialty Service, 1009-X Henry St., Detroit, Michigan.

FREE SAMPLES, 250 Letterheads, Envelopes or Cards $1.25. Globeprint, 5518 Norwood, Baltimore, Maryland.

1000 2-COLOR SHIPPING Labels size 4¼ x3 inches $1.50. Sample. "Art" Perritt, Garland, Texas.

"HOW TO Sell Printing By Mail"—Free to printers. Press, Box 562-MI, Georgiana, Alabama.

150 8½x11 LETTERHEADS AND 100 Envelopes $1.25. W8JHP, Pottsville, Pennsylvania.

SPECIAL! 200 BOND letterheads, envelopes, 89c. Joseph Johnson, 1382 Fifth Ave., New York.

PRINTING OUTFITS & SUPPLIES

INEXPENSIVE 6x9 PRINTING Press. Details Free. Novelty Shop, Downsville, Louisiana.

RUBBER STAMPS & MARKING DEVICES

ONE LINE 15c. 2 Lines 25c. 3 Lines 35c. Excello Sales Co., Shreveport, Louisiana.

HOBBIES & COLLECTIONS

BEAUTIFUL STONES removed from rings, etc. 100 assorted $2.00. Lowe's, Box 311, St. Louis, Missouri.

20 DIFFERENT CACTUS plants $1.00 postpaid. Lida Delap, Azusa, California.

JOIN MATCHBOOK Club—25c. Free covers. Box 101-A, Rochester, New York.

INDIAN CURIOS, RELICS, ANTIQUE FIREARMS

25 GENUINE INDIAN Arrowheads, $1.00. Catalog. Geo. Holder, Glenwood, Arkansas.

RARE COINS

COIN COLLECTORS—Read "The Numismatist." Published monthly. News, illustrated feature articles on coins and medals. Sample copy 25c. American Numismatic Association, 99 Livingston St., Brooklyn, New York.

WE BUY Indian Cents, Lincoln Cents, Old Rare Coins Wanted. Highest prices paid for all U. S. Coins. Send 10c for New 1943 Price Catalog. American Rare Coin Co., Dept. 2, Transportation Bldg., Chicago.

FREE! FOREIGN Coin, banknote and large 50 page illustrated coin catalogue to approval service applicants. Send 3c postage. Tatham Coinco., Springfield-9, Massachusetts.

COMMEMORATIVE 3½c. Columbia, Lincoln, Stone-Mountain, Long-Island, Cleveland, $1.00 each. Large illustrated Catalogue 25c. N. Shultz, Salt Lake, Utah.

20 DIFFERENT INDIAN Head Cents $1.10. Includes Buying, Selling Lists. Large Catalogue 8c. Bebee Coin Co., 1180 East 63rd, Chicago.

1943 COIN HANDBOOK, Premium List. Beautifully Bound, $1.00 Postpaid. Schembs, 668 Fern, Yeadon, Pennsylvania.

ELEVEN DIFFERENT Finely Selected Coins, 25c. Oddchon, Box 44, Overland, Missouri.

STAMP COLLECTING

POSITIVELY GREATEST Free Offer—Latest Scott's International $4.00 Stamp Album—covering entire World, contains 36,000 illustrated, descriptive spaces; Scott's 1943 Standard $4.00 Catalogues "Philately's Encyclopedia"—absolutely Free to applicants for Foreign Approvals becoming customers. Bargain Stamp Service, Palm Spring, California.

MacARTHUR COMMEMORATIVE Stamp from Australia; Indo-China "Bomber" and new Cuba "V-for-Victory" stamps; scarce $1.00 Abyssinia; also packet fine stamps from Far East war zones. Total catalogue price over $1.25. Everything only 5c to serious approval applicants! Fittsco, Dept. 21A, Framingham, Massachusetts.

WORLD'S SMALLEST Airmail—Diamond and Triangle Stamps. Free Stamp Magazine, also magnifier to study your stamps, with large collection of stamps from scarce countries. A Bargain. 5c with approvals. Capital Stamp, Dept. 21, Little Rock, Arkansas.

44 DIFFERENT UNITED STATES including $5.00 stamp, or complete set United States Bicentennials, or 25 different United States commemoratives cataloging 55c, or 30 different obsolete Canada. 13c postpaid with approvals. Cobb's, 61 Beekman St., New York.

MR. STAMP-DEALER: How are the orders coming in? If they're piling up fast, you don't need me. But if you're not making a good profit in these times, let me tell you how to up your sales. Write today to K. Burkhart, 226 West 78th St., New York.

THICK PACKET stamps with odd shapes. Air Mails, United States, Commemoratives, Albania, Greece (Red Cross), Bolivia, and multitude others. Everything 10c to approval applicants. Kellerman, RR #10, Sta. M, Box 176, Cincinnati, Ohio.

BARGAIN UNITED States—Complete set of used #756-65 (1c-10c) National Parks imperf (1935)—75c. Approvals sent on request, both American and foreign. Griswold's Stamp Mart, 108 Blinman St., New London, Connecticut.

FREE! LEEWARD Is., Cayman Is., Turks & Caicos plus 60 different mint Geo. VI Coronation poster stamps, to approval service applicants sending 3c postage. Tatham Stampco., Springfield-D-9, Massachusetts.

19TH CENTURY U. S. Commens. Civil War Revenues. Battleship $5 & $10 stamps. Illustrated U. S. Catalogue Free to U. S. Approval Applicants. Metropolitan Stamps, 198R Broadway, New York.

FREE YOUR choice of any 10 stamps from our first U. S. Approval selection. Illustrated list included. Cosmopolitan Stamp Company, Dept. 3-X, 1457 Broadway, New York City.

FINE APPROVALS, freshly mounted. Fast, personal service. Tell me what countries you prefer and I'll send their stamps. Milt Skinner, 345 East Ocean, Long Beach, California.

U. S. PRESIDENTIALS complete ½c to $5.00, $1.25. Famous Americans 40c. 35 Different Commemoratives 25c. M. Simmons, 4312 North Bernard St., Chicago, Illinois.

300 VARIETIES FOREIGN; extras cataloging $1; stamp exchange membership—all for 50c. Potter Stamp Exchange, 544 Harps St., San Fernando, California.

FREE! COMPLETE "United States" stamp catalog, 1,000 illustrations! Send 3c for postage. Harris & Co., 22 Transit Building, Boston, Massachusetts.

PHILATOPIC MONTHLY Free—Forty pages—profusely illustrated—Including Stamp Encyclopedia. Empire Stamp Company, Dept. MM, Toronto, Canada.

COLLECT FASCINATING Poster Stamps. Particulars, Lists, Large Package Stamps, 10c. Marcus, 74-B Bergen Ave., Jersey City, New Jersey.

UNITED STATES approvals, complete coverage, fine quality, attractive prices. Seminole Stamps, Box 436, Coconut Grove, Florida.

50 DIFFERENT, BETTER grade, United States Commemoratives, 30c postpaid. Charles Stone, 3547—28th St., Astoria, New York.

UNITED STATES 50 different 5c to approval applicants. Neumann & Co., 6728 W. Finger Place, Milwaukee, Wisconsin.

BAHAMAS #37 CATALOGUE, Value 35c, only 6c to serious approval applicants. Eds Hoffnagle, Blue Island, Illinois.

75 DIFFERENT U. S. commemoratives, 35c; 8 different U. S. airmails, 15c. Elton, 529 44th, Union City, New Jersey.

26 DIFFERENT FRENCH Colonials 5c with better value approvals. Excel Stamp Mart, Box 1315, Chicago.

20 DIFFERENT COMMEMORATIVES 5c! Approvals. Arthur Benton Ryan, Middletown, Connecticut.

1,000 MIXED POSTER Stamps and Patriotic Labels $1.00. Rooney, 116 Prince Street, New York City.

FIVE AIRMAIL Triangles, 5c, with approvals. Avalon Stampco., Springfield-9, Massachusetts.

400 MIXED U. S. Stamps, 10c. 5 & 10 Stamps, 1018 N. Rampart, Los Angeles, California.

50 DIFFERENT BRAZIL 10c Approvals. Pinehurst Stamps, 90-2 Pinehurst Ave., New York.

10 DIFFERENT PHILIPPINES 5c with approvals. Bacher, 815 16th Street, Greeley, Colorado.

165 DIFFERENT U. S. $1.00. (Includes $5.00.) Sunshine, 1511 Birch, Rockford, Illinois.

"APPROVALS" give you the opportunity to examine various assortments of stamps before buying. This is a special Courtesy Service extended by Stamp Dealers. Cooperate with them by looking over Approval Stamps as soon as you receive them. Then send payment for the stamps you keep; and return those you don't want.

TWENTY COMMEMORATIVES 5c. Pearl Paul, 2295 Grand Concourse, New York City.

60 DIFFERENT UNITED STATES 10c. Pricelist free. Seidenberg, Baroda, Michigan.

U. S.—FOREIGN approvals. Attractive prices. Midwest, 2241 East 71st, Chicago.

500 UNITED STATES or Foreign Stamps 25c. Hoffman, 2232 Grand, Butte, Montana.

PHILATELIC JOURNAL. Year 30 cents. M. Roselle, 37 Grove, Kearny, New Jersey.

U. S. USED and mint, on approval. Dunbar, 324 W. Brackenridge, Ft. Wayne, Indiana.

BIG PACKET (100) only 10c with approvals. Len's, Box 245X, Owatonna, Minnesota.

10 EXCELLENT SETS 10c, approvals. Edward Staten, Forrest City, Arkansas.

PENNY APPROVALS that please. McKee, 1217 Scott St., Covington, Kentucky.

3 CUBA SETS 10c with approvals. Pettell, 1610 So. Third, Maywood, Illinois.

FREE 25 U. S. Approvals. Rock Stampco, Box 103, Eagle Rock, California.

TWO GOOD sets, 3c with approvals. Vargo Stamps, Racine, Wisconsin.

BODY BUILDING COURSES—ATHLETIC EQUIPMENT

SUPER JU-JITSU—lightning defense and attack system. Sensational new home-study course now ready! Learn to lick brutes twice your size with only your bare hands. Free details. Nelson Co., 500 Sherman, Dept. C-507, Chicago.

BE STRONG, muscular, full of pep. Amazing new body-building course. Write Olympic System, Dept. M, Waterville, Maine.

SUPER SYSTEM Of Natural Physical Training. Free booklet. Harry Good, 3261-X Watson Rd., St. Louis, Missouri.

CHALK TALKS

TRICK CHALK Stunts. Catalog 10c. Cartoonist John Balda, Oshkosh, Wisconsin.

DETECTIVES

DETECTIVES—SECRET Investigations—Easy Method By Former Government Detective. Finger-prints, Secret Code Booklet, Free. Write—International Detective Training, Box 756-M Journal Sq. Station, Jersey City, New Jersey.

DETECTIVES—WORK Home—Travel. Experience unnecessary. Detective Particulars free. Write, George Wagner, J-125 West 86th, New York.

SECRET DETECTIVES make big money. Rewards. New training method. National Detective Service, Struthers, Ohio.

GAMES—ENTERTAINMENT

PLAY BIG league baseball games at home with exciting Jig Time Baseball. Complete with score sheets—50c, 3 for $1.00. Ted Vernon, 2315-13th St., Lubbock, Texas.

HYPNOTISM

HYPNOTISM. COMPLETE 20 Method Course 25c. Western Institute Hypnotism, D-1313, Palatine, Illinois.

JIU JITSU

JIU JITSU 3 lessons 10c. Investigate the course experts buy—the real thing. Send 10c for 3 trial lessons, details. (Session 1 is $1, money-back guarantee.) Write today. The Modern School, Box 88-A, Forest Hills, New York.

MAGIC TRICKS, JOKERS, PUZZLES

SEND TEN cents for list of professional tricks selling for one dollar and less. Thayer's, Box 1785 Wilshire-La Brea Station, Los Angeles, California.

BAFFLE YOUR Friends! Something new! 25c gets you cards and instructions complete. Ray Specialty Service, 1009-X Henry St., Detroit, Michigan.

HITLER ASH tray novelty. Jam your butts in Der Fuehrer's mouth. 35c, no stamps. Pentucket Arts, Haverhill, Massachusetts.

WE SUPPLY every noted magician. Large Professional catalog 25c. Holden, 222 West 42nd St., New York.

SIXTEEN WORLD'S best card tricks and catalog 25c. Sterling Magic, 345 John R., Detroit, Michigan.

MAGNET TRICK Instruction Book—25c. Central Station, Box 1676, Toledo, Ohio.

MYSTIFYING TRICKS Free. H. E. Willis, Box 1704, Cleveland, Ohio.

SONGWRITERS

POEMS MADE into songs. Reasonable fee. Reliable professional composer. Submit poem if reply desired. Ahlstrand Melodies, Kettle River, Minnesota.

SONGWRITERS—SEND Poem for Immediate Consideration and Free Rhyming Dictionary. Richard Brothers, 166 Woods Building, Chicago.

SONGWRITERS—GET the facts. Free informative booklet, plan. Write today. Song Service, 331-A West 46th, New York.

SONGWRITERS. WRITE for free booklet, Profit Sharing Plan, Allied Music, Dept. 45, 204 East Fourth, Cincinnati, Ohio.

SONG POEMS Wanted: Write For Free Instructive Booklet. United Music Corporation, Dept. 19, Salem, Indiana.

ORIGINAL MUSIC composed to your words. Reginald Belcher, Chatham, New Jersey. Established 1910.

REPRESENTATIVES WANTED. Irving Siegel, Music Publishers, 1650 Broadway, New York.

SONGWRITERS! 50/50 COLLABORATION. Lyric criticism 35c. Lewis Elliott, Martin, Tennessee.

SHOP THESE COLUMNS WITH CONFIDENCE
ALL MECHANIX ILLUSTRATED CLASSIFIED ADS ARE GUARANTEED

SONGWRITERS! AMAZING, outstanding offer. Hibbeler, C-32, 2157 No. Avers, Chicago.

WANTED: ORIGINAL Song Poems. Five Star Music Masters, 629 Beacon Building, Boston.

TATTOOING SUPPLIES

TATTOO OUTFITS $1.50 up. Write today. Zeis Studio, 738 Lesley, Rockford, Illinois.

BOOKS, PERIODICALS, PICTURES, POSTCARDS

AFTER THE War . . . What? Will Hitler, Churchill, Roosevelt, or the Pope win? What does the Bible tell us? 25c (coin). Five for $1.00. Box 4340, Washington, D. C.

REBINDING: HAVE your old books, Bibles and Hymnals rebound. We bind magazines. Write for prices. The Heckman Bindery, Dept. H—North Manchester, Indiana.

BEAUTIFUL VIEW Card of Atlanta, Georgia. Free if you send 3c stamp for trial listing in my Card Exchange. Thigpen, Box 97-I, Bolton, Georgia.

ACTION PICTURES—Favorite Orchestra Leaders, Vocalists. 25c; 5, $1.00. Arsene, 1585-MI Broadway, New York, New York.

CAMERAS & PHOTO SUPPLIES

MAKE MONEY in photography. Learn quickly at home. Easy plan. Previous experience unnecessary. Common school education sufficient. Booklet and requirements free. American School of Photography, 1315 Michigan, Dept. 2043, Chicago.

HOME MOVIES

KODACHROME SUBJECTS for grownups. Lists, sample, 10c. Projection length Waikiki Hula test film, $1.00. Specify 8-16mm. Jenkins, 392, Elmira, New York.

SEND $1 FOR useful "Surprise" Assortment colorful 8MM Titles! LeMoine Films, Nevada, Missouri.

MOTION PICTURES & SOUND EQUIPMENT

COMPLETE 16MM sound subjects—$1. (Need splicing.) All sizes film bought, sold, exchanged. Catalogue—Sample film—10c International-I, 2120 Strauss, Brooklyn, New York.

FREE, 1943 MOVIE Catalog; sample films 10c. Projectors, supplies. Goodwill Company, Jackson, Tennessee.

8-16 MM. FILM Subjects, $1.00 up. Lists, stamp. Pence Service, 2484 Liddesdale, Detroit, Michigan.

KODACHROME 8-16MM. projection length sample $1.00, specify size. Griffin, Box 21, Ithaca, New York.

PHOTO FINISHING

DOUBLESIZE 4x6 PRINTS, Quality Work. Guaranteed. Everlasting Hi-gloss finish. Overnight service. Your roll developed and 8 4x6 prints, from 116-120, 30c; 12 exposure roll, 40c; 16 or 18 exposure roll, 55c; 36 exposure roll, $1.10. Reprints, 4x6, 3½c each. No order less than 25c. Get our low prices on enlargements, dbl. weight velvet finish, and copies made from new & old prints. Send for mail bags. Pacific Photo Service, Box 666, San Francisco, California.

REPRINTS 2½c EACH, 100—$2.00. 6 or 8 exposure rolls developed 2 prints each exposure 25c. 36 exposure 35mm rolls fine grain enlarged prints $1.00. Mailing envelopes Free. Mercury, D-109 North Dearborn, Chicago.

EVERY PICTURE an enlargement! 8 sparkling deckle-edge Enlargements and roll developed 25c coin; 116 size or smaller; enlarge reprints 3c. Enlarge Photo, Box 791C, Boston, Massachusetts.

AMAZINGLY BEAUTIFUL hand colored prints 6-8 exposure roll developed, printed 25c trial. Reprints 4c each. National Photo Art, D-M, Janesville, Wisconsin.

ALL ENLARGEMENTS from your eight exposure roll film 25c. 12 exposure roll 36c. 16 exposure 41c. Aberdeen Film Service, Box 1149, Aberdeen, South Dakota.

5x7 ENLARGEMENT. 15c, TEN for $1.00. Send negatives. 8 exposure rolls, 25c. 16 exposures, 45c. DeVane's Photo, Melville, Louisiana.

AUTOMOBILES—MIDGET CARS

WHIRLGAS SUPERCHARGERS, $2, increase mileage 20%; power 10%. Refund guarantee. University test. Any car: give make, year. Wrench installs 15 minutes. John Hanley, Manufacturer, 5719 Loraine, Detroit, Michigan.

AUTO SUPPLIES & EQUIPMENT

DIESEL CONVERSIONS for Auto, Tractor, and Marine Engines. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate. Write for free circular No. 5A. Harrington Company, 201-204 Manchester Building, Portland, Oregon.

NEW SCIENTIFIC tablet saves Gas up to 30%! Results guaranteed. Positively Harmless—$1 box treats 180 gallons—C.O.D. or Postpaid. (Liberal supply 25c.) Distributors Wanted. Gas-O-Lubri Products, K-3338 Manderson, Omaha, Nebraska.

NEW 5c PILL saves gas and oil and repairs. Increases Compression Power and Pickup. Quicker Starting. Saves Battery. 500 Mile Treatment only 25c. Agents Wanted. Write J. R. Beaman, 411 Coolspring St., Fayetteville, North Carolina.

CHEMICAL DISCOVERY. Get 20 extra gallons of gasoline by placing "Gas-O-Lub" in gas tank. It is harmless to your motor. Send $1.50 for trial package to R. Bensi, Box 134, Dearborn, Michigan.

FUEL OIL Conversions for Automotive, Marine engines, write for free literature. Houston & Logan Conversions, 2112 Addison, Berkeley, California.

MOTOR OVERHAUL Compound: Unnecessary to take motor apart. Quick. Cheap. Formula $1.00. R. Plumb, Herkimer, New York.

1943 IGNITION SUPERCHARGER $2.50. Fast Starting Mileage, Pep. E. G. Sales Mfg. Co., 60 John Street, New York.

AUTO-OWNERS SPECIAL! Ten Automotive Formulas $1.00. Monroe-Methods, Box 4766, San Francisco, California.

GASLESS GAS! Quickly. Easily Compounded. Formula 25c. Dueffy, Covington, Kentucky.

MOTORCYCLES, BICYCLES, MOTOR SCOOTERS

GERMAN WAR Motorcycle, Shaft-driven, full details, illustrations, drawings described in British Magazine reprint. Catalogs Motorcycles, Scooters, Bicycle engines. 35 cents coin, stamps. Clymere, 307 W. Pico, Los Angeles, California.

"MODERN MOTORCYCLE Mechanics," 436 page book, 200 illustrations, just published. Extensively covers—Operating, maintenance, complete reconditioning, American and British motorcycles. $2.50 postpaid. Descriptive folder free. Nicholson Brothers, Saskatoon, Sask., Canada.

SAVE GASOLINE, Tires! Motor-scooters, Motorcycles, Bicycle Motors, Midget Automobiles, Gasoline Engines. No priority necessary. Illustrated catalog one dime. Clymer, 307-A West Pico, Los Angeles, California.

BATTERIES, LIGHT PLANTS, GENERATORS

EDISON BATTERIES for light, power. Fifteen year life. Five year unconditional guarantee. Complete lighting plant bargains. Free illustrated literature. Seejay Company, 321 Yonkers Avenue, Yonkers, New York.

RENEW DEAD car batteries inexpensively. Get wise. Instructions $1.00. Popular Service, Racine, Wisconsin.

ELECTRICAL SUPPLIES & EQUIPMENT

MOTORS, GENERATORS, Welders, Fencers, other electrical items. Priority unnecessary. Write LeJay Manufacturing, Minneapolis, Minnesota.

ELECTRO-MAGNETS—Complete Plans for Building, Alternating or Direct—$1.00. Terry Sales, Central Station 1676, Toledo, Ohio.

ELECTRIC PENCIL: Writes—Engraves all Metals. $1.00 postpaid. Beyer Mfg., 4515-C Cottage Grove, Chicago.

ENGINES, MOTORS

LIKE NEW, 3 H.P. motor, 60 cycle, three phase, 440 volts, 1100 speed. Heavy Duty, $65.00, 2 H.P. Repulsion, 110 volts, 3100 speed, single phase, $40. Robert Reof, Box 516, Anderson, Indiana.

MACHINERY, TOOLS & SUPPLIES

NEW CALIPER, direct reading, speeds up defense work, cheap. Free Illustrated circular. Factory, 811-F East 31st, Kansas City, Missouri.

USED WOOD & Metal working Power Tools, bought, sold, exchanged. Details Free. National Tool Mart, Ashburn, Georgia.

GRIND DRILLS like factory: attachment for bench grinder. Cheap. Factory, 811-C East 31, Kansas City, Missouri.

WELDING—PLATING—SOLDERING

MAKE YOUR own electric welder. Complete kit. Everything supplied with full directions for assembly. $5.95. Will make a $19.95 set. Marvel Electro Welder Mfg. Co., 195-M Centre St., New York City.

USE GASOLINE for welding and cutting. Make your own torch. Instructions One U. S. dollar. Matthews Mfg. Co., Red Deer, Alberta, Canada.

FOR INVENTORS

INVENTORS—TAKE prompt steps to protect your invention. Delays are dangerous. Get new Free book, "Protect, Finance and Sell Your Invention," and "Invention Record" form. Preliminary information free. Reasonable fees. Conscientious counsel. Easy payment plan. Learn how to protect and sell your invention. Write us today. McMorrow & Berman, Registered Patent Attorneys, 138-Z Albee Building, Washington, D. C.

PATENT YOUR Idea! Write immediately for two free illustrated books, "Patent Protection" and "When and How to Sell an Invention", 64 pages of valuable information for inventors. No obligation. Address: Victor J. Evans & Co., 770-C Merlin Bldg., Washington, D. C.

INVENTORS: NEW military and commercial inventions urgently needed by manufacturers. Write for particulars. Chartered Institute, Dept. 5-B, Washington, D. C.

GET YOUR own patents. Blanks, instructions $1. Cudding Sons, Campbell, California.

CASH FOR practical ideas and inventions. Mr. Ball, FA-9441 Pleasant, Chicago.

INVENTIONS WANTED

MANUFACTURERS ALL over the country are giving thought to a post-war market. What have you new to offer? Patented or unpatented. Albert G. Burns, Alameda, California.

INVENTORS: HAVE you a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 5-C, Washington, D. C.

INVENTIONS PROMOTED. Patented or unpatented. Write Adam Fisher Company, 582 Enright, St. Louis, Missouri.

CASH FOR Inventions—patented or unpatented. Mr. Ball, FB-9441 Pleasant, Chicago, Illinois.

MODEL RAILROAD SUPPLIES

RAILWAY MODELS, Complete Line Informative Catalogs O gauge 112 Pages 25c, HO 48 Pages 15c. Walthers, 235 Erie, Milwaukee, Wisconsin.

PATENT ATTORNEYS

INVENTORS: LEARN now—without obligation—how to protect and sell your invention. Secure Free "Record of Invention" form—and Free "Patent Guide", containing complete information about patent procedure. Write—Clarence A. O'Brien & Harvey Jacobson, 33B-C Adams Building, Washington, D. C.

"INVENTOR'S GUIDEBOOK" containing 96 mechanical movements and advice about patenting, selling inventions, also "Record of Invention." Free. Frank A. Ledermann, Registered Patent Attorney, 154 Nassau Street, New York.

PATENT PARTICULARS and Blanks, Free: Government-Registered Patent Attorney 36 years. Sterling Buck, I-Hotel Plaza, Washington, D. C.

PATENTS

INVENTORS:—FORESIGHTED manufacturers already planning post-war sale of new non-military products. If you have a useful invention, patented or unpatented, write Chartered Institute of American Inventors, Dept. 5A, Washington, D. C.

INVENTIONS PROMOTED. Patented or Unpatented. Write Adam Fisher Company, 582 Enright, St. Louis, Missouri.

PATENTS FOR SALE

PLASTICS PUTTY gun, dispenses uniformly, continuously. T. Pasanen, Franklin Mine, Michigan.

ARCHERY

ARCHERY EQUIPMENT: Catalogue Free. Mid-West Archery, 2209-C East 75th, Chicago.

BLUEPRINTS & PLANS

ATTENTION, ALL Defense Workers! Make More Money. Do a Better Job. Study—"Blueprint Reading." Clear, Practical and Complete Instruction. $2.50 Postpaid. Act Today. E. Luckey, Box 1091, Bethlehem, Pennsylvania.

BOATS, OUTBOARD MOTORS

FULL SIZE cut to shape patterns, blueprints. $3.75 up. Pleasure boats, to 38 feet. Illustrated "Build A Boat" catalog, 10c. "How to Build Boats" book, $1.00. Cleveland Boat Blueprint Co., Station A-23C, Cleveland, Ohio.

OUTBOARD MOTORS—used and rebuilt bargains, list free. Used parts, save money. Crandall-Hicks Co., 953 Commonwealth, Boston, Massachusetts.

SAILS; 100 SQUARE foot kit $6.95, also other sizes. Canvas any width. Boat equipment. Alan-Clarke Co., 98 Chambers St., New York City.

HOME CRAFTSMEN

CATALOG:—PATTERNS Plywood Novelties, Lawn Ornaments, Silhouettes, Letters & Numerals, Decal Transfers, Handy Hand Tools, New Power Sander. Other lines, 500 articles finely illustrated. Write today. Wo-Met Shop, Ashburn, Georgia.

VIOLIN WOOD, Indian Relics, Antique Firearms, Fossils. Catalogue 10c (Photographs of Most). Museum, Wenona, Illinois.

USED WOOD & Metal working Power Tools, bought, sold, exchanged. Details Free. National Tool Mart, Ashburn, Georgia.

NEW, DIFFERENT:—25 patterns for sheet plastic 25c. 15 novelty patterns 25c. Lynda, Medway, Massachusetts.

MAKE TELESCOPES, microscopes, cameras, magnifiers. Trifling cost. Jamer, Manorville, New York.

SPORTING GOODS, FISHING TACKLE, GUNS

"BUY WAR BONDS." Derryhoyle House, Natick, Massachusetts, buys, sells and exchanges ancient and modern firearms, and always gives Real Value, with Guarantee. We also sell on commission. List and message for stamp.

276 ANTIQUE FIREARMS, Swords, Cartridges. Catalog 10c. (Photographs of Most.) Heike, Wenona, Illinois.

SEND 10c FOR list 100 used guns. Frayseth's, Willmar, Minnesota.

SPECTROSCOPES

SPECTROSCOPE FOR quick chemical analysis $2.50. Cudding Sons, Campbell, California.

FIELD GLASSES, TELESCOPES, MICROSCOPES

LENSES—BUILD your own telescope, field-glass, microscope, riflescope, etc. Assortment of fifteen lenses—$1.00 postpaid. Thirty lenses—$2.00. Sixty different lenses—$5.00. Slightly chipped on edge. Satisfaction absolutely guaranteed. American Lens Company, 1313-X Vine Avenue, Park Ridge, Illinois.

ASTRONOMICAL TELESCOPES, binoculars, cameras, microscopes; bought, sold, repaired. Send 10c for list of instruments desired. Rasmussen, Box 294, Amsterdam, New York.

REAL ESTATE, FARM LANDS

VIRGIN FRUIT, poultry, timber lands. $1.00 Acre. Armstrong, Thornburg, Iowa.

MINERALS & PRECIOUS STONES

FASCINATING MINERALS. 25 labeled specimens, $1.25. Catalog, 5c. Scott Lewis, 2500 Beachwood Dr., Hollywood, California.

MISCELLANEOUS

SUPERWAX PRESERVES, waterproofs canvas, rope, leather goods, shoes. Waxes cars, skis, metal, woodwork. 1½ lbs., $1. Full directions. Superwax, Box 1492-B, Milwaukee, Wisconsin.

1943 DESK CALENDARS including 12 Famous Esquire Varga Girls. Only 50c each. Cash with order. H. Budin, 19 Albany, New Brunswick, New Jersey.

RECEIVE GIGANTIC mails, magazines, samples. Your name in numerous mailing lists 10c. Howard, 396 Broadway, New York.

HEATING COSTS cut 50%!! Guaranteed. Sworn Statement, circulars 10c. Rosenzweig, RR10-C-2, Cincinnati.

MORE HEAT with less fuel. Simple device fits inside oil burner, burns up smoke. Amazing results. Jankas, 1901 Canalport Ave., Chicago.

BURIED TREASURE, Minerals, free booklist, photographs. Fisher Laboratory, Palo Alto, California.

PERSONAL

DISCOVER YOUR true self. Acquire mind power, attract success, companionship, through Ontology, science of reality. Gain health, happiness, confidence, independence. Ontology solves problems, overcomes obstacles, promotes security, explains Bible, answers prayer. Astounding revelations. Free booklet. Alexander Keene, X-3, Sedalia, Missouri.

DEFORMED OR Injured Backs. Philo Burt Spinal Appliance gives support for relief and benefit. Made to Measure and meet needs in each case. 30 Day Trial. Describe your trouble and we send full information. Philo Burt Company, 18 Odd Fellows Temple, Jamestown, New York.

YOUR SUB-CONSCIOUS mind can and will give you what you desire, when you know how to Direct it. Write for our free treatise "Creative Power is available to you." Creative Thought Studio, P. O. Box 1, Greendale Station, Worcester, Massachusetts.

BIRTH CERTIFICATES, all ages, any state, ten (10) day service. Enclose postage. Herndon J. Thompson, Dept. D-324, Davis, Oklahoma.

POEMS WANTED—"Capener's Magazine" 10c, $1.00 year. Big Mail Monthly. 849 Almaden, San Jose, California.

JESUS CHRIST prophesies end of present War. Particulars Free. Box 363-F, Farmland, Indiana.

PERSONAL PHOTOSTAMPS. Any print. 100—$1.00. Arthur Schyllander, Station C, Toledo, Ohio.

WANTED TO BUY

MINERALS, FOSSILS, confederate notes. Large lots. Curio Shop, 85-4th Ave., New York, New York.

MERCURY (QUICKSILVER) $1.50 per pound. Western Metal Co., Bloomington, Illinois.

60 ART LESSONS

Only $1.95 POST PAID

COURSE COMPLETE

Study art in privacy of your own home in spare time with this course by Alexander Murray, author and art instructor. Lessons deal with commercial art, cartooning, lettering, anatomy, perspective, layout, etc. No added expense or bother of correspondence. Over 815 instruction illustrations. Order now . . . get all 60 lessons plus 65 sheets of drawing paper. Send only $1.95 for complete course postpaid —or if in U.S.A. pay postman plus postage. MONEY BACK if not delighted after inspecting.

EDUCATIONAL SUPPLY CO. Dept. 143-C RACINE, WIS.

MILLIONS of WAR WORKERS NEED THESE WORK GARMENTS

MAKE GOOD MONEY *EVEN* IN YOUR SPARE TIME

All-out war production creates huge demand for MASTER fine work garments. You be our local dealer. Take orders in spare time. Big selection of good-looking industrial clothing. Advertising embroidered on garments great sales feature. Some single orders bring our men as much as $75. No experience necessary. We supply everything. Write immediately for FREE Outfit.

GEO. MASTER GARMENT CO.
Dept. D-43 Ligonier, Indiana

SPEAK SPANISH

LEARN THIS EASY WAY

ONLY 15 MINUTES A DAY. Know a second language for better business or social position; read foreign books; really enjoy travel. Speak like a native. Learn quickly, easily at home just "by listening" to CORTINA RECORDS as thousands have! Cortina-phone Method famous for 60 years. Write today for free book "The Cortina Short-Cut." State language interested in.

JUST LISTEN TO THIS RECORD

CORTINA ACADEMY, SUITE 273,
105 West 40th Street, New York, N. Y.

DRAFTSMEN NEEDED Now

Industry is clamoring for more draftsmen for the job can't start until plans are drawn. Buildings, airplanes, machines, guns, tanks, bridges, all start on the drafting board, so it's no wonder that every good draftsman has a fine job. Yes, more draftsmen are needed NOW. The pay is good and the opportunities for advancement great.

Learn at Home in Spare Time

Begin now to turn spare hours into money. Be a draftsman, the connecting link between a mechanic and an engineer. Enjoy the wonderful opportunities for promotion that exist now. No experience or artistic talent is needed. You don't have to leave your present job while learning. Use spare time.

American School, Dept. DD328, Drexel Ave. at 58th St., Chicago, Ill.

Gentlemen: Send me FREE information covering special training in subjects checked below. No obligation on my part.

- ☐ Drafting and Design for Men and Women
- ☐ Cost Accounting for Manufacturing
- ☐ Architecture and Building
- ☐ Automotive Engineering
- ☐ Business Management
- ☐ Electrical Engineering
- ☐ Diesel Engineering
- ☐ High School Course
- ☐ Plastics
- ☐ Mechanical Engineering
- ☐ Aviation ☐ Radio
- ☐ Shipbuilding

Name .....

Address .....

PLUMBERS & STEAM FITTERS

Audels Plumbers and Steamfitters Guides

4 Vols. $6

A practical, illustrated, Reference Library and Study-Course for Master Plumbers, Journeymen and Apprentice Steamfitters, Gas Fitters and Helpers, Sheet Metal Workers, Draughtsmen, Master Builders, Engineers and all Building Trade Students. This valuable set of handy, pocket-size Guides explains in practical common language and well-done illustrations all the principles, advances and short cuts of the Plumbing and Heating trade —based on modern practice. Contains careful, detailed instructions on how to figure and estimate various jobs. Use FREE COUPON below to examine, without obligation, this valuable work.

INSIDE TRADE INFORMATION ON:

Soldering, tinning. Joint wiping, bending, beating. Pipe—iron—steel, threading. Mathematics, tables, physics. Materials—iron, steel, copper, brass, lead, tin, antimony, etc. Sheet metal—galvanized—plate. Sanitation, syphonage, tanks. Drainage, sewage, purification. Fixtures—bath —kitchen. Pipe fittings, soil pipe, tools. Laying out work. Roughing. Screwed fittings, flanges, joints. Pipe bending, examples. Elbows. Heating, ventilation, air conditioning, refrigeration. Water supply, mains, wells, tanks. Gas-fittings. Sheet metal work, problems, methods. Brazing, heating, lead burning. Welding, various welds, methods. Blacksmithing, forges, tools. **Air Conditioning.**

THEO. AUDEL & CO., 49 W. 23rd St., New York City

Mail Audels Plumbers Guides, 4 vols., on 7 days' free trial. If O. K. I will remit $1 in 7 days, and $1 monthly until $6 is paid. Otherwise I will return them. No obligation unless I am satisfied.

Name .....

Address .....

Occupation .....

Reference ..... MM

SUPER JU JITSU

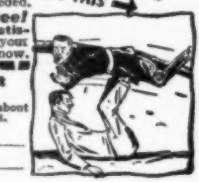
WHEN THIS HAPPENS TO YOU...

NOW— YOU CAN *Destroy Your Enemy Quick!*

BE A ONE-MAN BLITZ! Strike with Commando lightning! You don't need ox-like muscles to use Super Ju Jitsu, most powerful of all defense and attack methods. **Technique** is the deadly secret. Brains count—not size, not strength. Almost miraculously efficient.

Gain Self-Confidence

KNOW how YOU can lick brutes twice your size with your bare hands only, even when they are ARMED with gun, knife, club. Get ready now for any emergency—protect your loved ones. Amazing self-study course teaches you double-quick. No boring exercises needed.



Send for Exciting Details—Free!

FREE Startling Low Price. Satisfaction Guaranteed or your money back. Mail coupon now.

NELSON CO., 500 Sherman Street DEPT. C-501, CHICAGO, ILL.

Please rush me free the hard-hitting details about "Super Ju Jitsu." No obligation on my part.

NAME .....

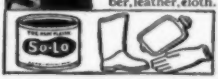
ADDRESS .....

FIX *Your* TIRES

So-Lo SAVES RUBBER

Use "plastanoid" SO-LO to fix cuts, bruises, worn spots in tires. SO-LO also mends shoes, raincoats, boots —anything of rubber, leather, cloth.

MEND the HOLE for 1¢



SPREADS ON like butter. Dries tough overnight. Flexible. Non-skid. Waterproof. Won't come off—*guaranteed.*

So-Lo AT HARDWARE & 10c STORES

STUDY AT HOME

With A Chartered Educational Institution

Courses in ENGINEERING: Electrical; Civil; Mechanical; Drafting; Architectural; Automotive; Steam; Diesel; Aeronautical; Radio; Structural; Mining; Industrial; Highway; Petroleum; Marine; Refrigeration; Air Conditioning; Chemical.

Courses in ARTS AND SCIENCES: Philosophy; Education; Letters; Psychology; Public Health; Medical Jurisprudence; Sociology; Physics; Chemistry; Geology; Fol. Science; Theology; Law; Business and Commerce; Accounting; Mathematics; Statistics; Agriculture.

McKINLEY-ROOSEVELT INCORPORATED, 4610-CC, Sheridan Rd., Chicago

ELECTRICITY MEN NEEDED

Electricians are needed everywhere. Hollywood studios alone claim shortage 200 men. This is a live money making profession. Learn at home, spare time. Easy payments. Selective Employment service. Write for FREE Bulletin. No obligation.

AMERICAN SCHOOL

Dept. EE328 Drexel at 58 St., Chicago

PSYCHO-POWER

DYNAMIC MENTAL FORCE

Success—Health—Happiness

OBTAIN YOUR DESIRES

AN AMAZING *Secret*

Priceless Secrets of Success, Happiness, Personality, Wealth and Health revealed! Revolutionize your Life! FREE BOOKLET, entitled, "An Amazing Secret", 24 pages, sent to you upon request. No obligation. PATY CO., 618 South Western, D. T. 14, Los Angeles.

DO YOU

WANT a permanent business profession of your own? Then become a foot correctionist. Earnings of men and women in this greatly needed profession run as high as $50.-$100. weekly after a few weeks home training—not medical or chiropody—easy terms, no further capital needed, no goods to buy. 47th year. Write for free booklet.

Stephenson System of Foot Correction, 11 Back Bay, Boston, Mass

Want a Government Job?

START

$1260 to $2100 Year

Men—Women

Thousands appointments being made in 1943.

32-Page Civil Service Book—FREE

Mail Coupon today sure.

COUPON

FRANKLIN INSTITUTE
Dept. A-257, Rochester, N. Y.

Sirs: Rush to me without charge (1) 32-page book with list of U. S. Government Big Paid jobs. (2) Tell me immediately how to qualify for one of these jobs.

Name .....

Address .....

Editor's Workbench Chips

[*Continued from page 25*]

and get busy. Afterwards, you might have your wife or youngster snap a picture of you riding happily along on your new velocipede. Send it in to us, and don't forget to tell us how wonderful we are. . . .

Aviation Dictionary

ONE of the most interesting books on aviation we've seen for some time in Assan Jordanoff's new *Illustrated Aviation Dictionary*, published by Harper & Brothers, New York. Starting with "Ace" and winding up with "You've had it," it covers every imaginable term and slang phrase used in aviation and illustrates each item. It's our best bet of the month for flying fans.

Jeep, Jeep!

NOTHING has caught the imagination of Americans in recent years more than the Army Jeep. In advertisements, movies, magazines, newspapers and on the air the Jeep has been described, dissected, photographed, eulogized and promised as a post-war legacy to the public. When the last gun has stopped firing the Jeep will probably alter completely the face and living habits of the U. S. On the highway, on the farm, on the campus and in the garages of the nation it will be Jeep, Jeep, Jeep. And not without good reason. For the Jeep is as revolutionary a vehicle as the first Model A Ford (or should we say Model T Ford?) and has proved that it has everything any motorist could want except comfort. Maybe they'll even find a way to build that in, too. If not, who cares?

The Jeep, mind you, has what it takes. Speed, stamina, economy, four-wheel drive, power aplenty, and best of all, you don't even have to stay on the road with it. If you get bored with the signboards, or a man on a motorcycle is following you, off she goes into the woods, across the fields or downstream. Makes no difference to a Jeep. Think of the fun the farmer's daughter could have with her father's Jeep. She could plow the field in the morning, go to market with a load of vegetables in the afternoon, then home, change her dress and zip over to the dance at Crestville.

The moral of all this is—why wait until after the war for your Jeep? Of course, you'll have to if you want a stock job, but next month's issue of MI will contain plans and instructions for building the next best thing to a Willys. It's a nifty little 3-wheel job utilizing materials that you can locate without treading on any priorities. Holds two passengers or one passenger and groceries, without crowding. If you have an old washing machine o lawn mower motor lying around you're all fixe for power. The original car was built by an auto mechanic and repairman, and has been in use fo several months. Works like a charm. Be sure no to miss this in your April MECHANIX ILLUSTRATED

HOW YOU CAN BUILD A MIGHTY ARM

THIS BOOK Shows You HOW TO BUILD A MIGHTY ARM AND 16-in. BICEPS ONLY 25c TO YOU

A COMPLETE PICTURE COURSE ON ARM BUILDING

Why not get an arm of might with the power and grip to obey your physical desires? Weaklings whose arms were scrawny pieces of skin and bone have taken this course and in a short time developed themselves into strong men of powerful proportions with bulging biceps and brawny forearms . . . strong, solid arms of power that are respected my men and admired by women.

Learn The WORLD'S GREAT SECRETS OF ARM STRENGTH

This course is especially planned to build every muscle in your arm. Many pupils have developed a pair of triceps shaped like a horseshoe, and just as strong, and a pair of biceps that show their double head formation. The sinewy cables between the biceps and elbow are deep and thick with wire cable-like ligaments. The forearm bellies with bulk, the great supinator lifting muscles become a column of power, and their wrists are alive and writhe with cordy sinew. Wouldn't you like to have a magnificent arm like the figure pictured above?

You can't make a mistake. The strongest armed man in the world wrote this course for you. His great experience stands as proof that you can succeed. You get his secret methods of strength illustrated and explained as you like them. Rush only

SEND $1 FOR ALL 5

FORMERLY SOLD FOR $5 EACH. You any one of the courses listed in them for only $1.00.

Mail your order now will be included F muscle builder. show you wh them and h

Flight Lieutenant Kuttelwascher, a Czechoslovak by birth, has been a member of the famous International Squadron 1 of the R.A.F. Since he made his way to England after the fall of France. His decorations include the Czechoslovak Military Cross with second and third bar; the Czechoslovak Medal for Gallantry, with bar; the French Croix de Guerre three times; and the British Distinguished Flying Cross. His score, as he gave this first-person account of his experiences to Cecil Carnes, was 31 Axis planes.

friendly
ined to be
d Kuttel."
il me "Cat-
y to see in
ourse; it is
cumstances

until I have
ne enemies of
eradicate the

PLUMBERS & STEAM FITTERS

Audels Plumbers and Steamfitters Guides

4 Vols. $6

A practical, illustrated, Reference Library and Study-Course for Master Plumbers, Journeymen and Apprentice Steamfitters, Gas Fitters and Helpers, Sheet Metal Workers, Draughtsmen, Master Builders, Engineers and all Building Trade Students. This valuable set of handy, pocket-size Guides explains in practical concise language and well-done illustrations all the principles, advances and short cuts of the Plumbing and Heating trade —based on modern practice. Contains careful, detailed instructions on how to figure and estimate various jobs. Use FREE COUPON below to examine, without obligation, this valuable work.

INSIDE TRADE INFORMATION ON:

Soldering, tinning. Joint wiping, bending, beating. Pipe—iron—steel, threading. Mathematics, tables, physics. Materials—iron, steel, copper, brass, lead, tin, antimony, etc. Sheet metal—galvanized—plate. Sanitation, syphonage, tanks. Drainage, sewage, purification. Fixtures—bath —kitchen. Pipe fittings, soil pipe, tools. Laying out work. Roughing. Screwed fittings, flanges, joints. Pipe bending, examples. Elbows. Heating, ventilation, air conditioning, refrigeration. Water supply, mains, wells, tanks. Gas fittings. Sheet metal work, problems, methods. Brazing, beating, lead burning. Welding, various yalds, methods. Blacksmithing, forges, tools. **Air Conditioning.**

THEO. AUDEL & CO., 49 W. 23rd St., New York City

Mail Audels Plumbers Guides, 4 vols., on 7 days' free trial. If O. K. I will remit $1 in 7 days, and $1 monthly until $6 is paid. Otherwise I will return them. No obligation unless I am satisfied.

Name .....

Address .....

Occupation .....

Reference .....

SUPER JU JITSU

WHEN THIS HAPPENS TO YOU···

NOW— YOU CAN Destroy Your Enemy Quick!

BE A ONE-MAN BLITZ! Strike with Commando lightning! You don't need ox-like muscles to use Super Ju Jitsu, most powerful of all defense and attack methods. **Technique** is the deadly secret. Brains count—not size, not strength. Almost miraculously efficient.

Gain Self-Confidence

KNOW how YOU can lick brutes twice your size with your bare hands only, even when they are ARMED with gun, knife, club. Get ready now for any emergency—protect your loved ones. Amazing self-study course teaches you double-quick. No boring exercises needed.

DO THIS

OR DO THIS

Send for Exciting Details—Free!

FREE Startling Low Price. **Satisfaction Guaranteed** or your money back. Mail coupon now.

NELSON CO., 500 Sherman Street
DEPT. G-504, CHICAGO, ILL.

Please rush me free the hard-hitting details about "Super Ju Jitsu." No obligation on my part.

NAME _____

ADDRESS _____

FIX Your TIRES

So-Lo SAVES RUBBER

Use "plastanoid" SO-LO to fix cuts, bruises, worn spots in tires. SO-LO also mends shoes, raincoats, boots —anything of rubber, leather, cloth.

MEND the HOLE for 1¢

SPREADS ON like butter. Dries tough overnight. Flexible. Non-skid. Waterproof. Won't come off—*guaranteed.*

So-Lo AT HARDWARE & 10c STORES

STUDY AT HOME

With A Chartered Educational Institution

Courses in ENGINEERING: Electrical; Civil; Mechanical; Drafting; Architectural; Automotive; Steam; Diesel; Aeronautical; Radio; Structural; Mining; Industrial; Highway; Petroleum; Marine; Refrigeration; Air Conditioning; Chemical.

Courses in ARTS AND SCIENCES: Philosophy; Education; Letters; Psychology; Public Health; Medical Jurisprudence; Sociology; Physics; Chemistry; Geology; Pol. Science; Theology; Law; Business and Commerce; Accounting; Mathematics; Statistics; Agriculture.

McKINLEY-ROOSEVELT INCORPORATED, 4610-CC, Sheridan Rd., Chicago

ELECTRICITY MEN NEEDED

Electricians are needed everywhere. Hollywood studios alone claim shortage 200 men. This is a live money making profession. Learn at home, spare time. Easy payments. Selective Employment service. Write for FREE Bulletin. No obligation.

AMERICAN SCHOOL

Dept. EE328 **Drexel at 58 St., Chicago**

PSYCHO-POWER

DYNAMIC MENTAL FORCE

Success—Health—Happiness

OBTAIN YOUR DESIRES

Priceless Secrets of Success, Happiness, Personality, Wealth and Health revealed! Revolutionize your Life! FREE BOOKLET, entitled, "An Amazing Secret", 24 pages, sent to you upon request. No obligation. PATY CO., 618 South Western, D. T. 44, Los Angeles.

AN AMAZING Secret

DO YOU

WANT a permanent business profession of your own? **Then become a foot correctionist.** Earnings of men and women in this greatly needed profession run as high as $50.-$100. weekly after a few weeks home training—not medical or chiropody—easy terms, no further capital needed, no goods to buy. 47th year. Write for free booklet.

Stephenson System of Foot Correction, 11 Back Bay, Boston, Mass

Want a Government Job?

START

$1260 to $2100 Year

Men—Women

Thousands appointments being made in 1943.

32-Page Civil Service Book—FREE

Mail Coupon today sure.

COUPON

FRANKLIN INSTITUTE
Dept. A-257, Rochester, N. Y.

Sirs: Rush to me without charge (1) 32-page book with list of U. S. Government Big Paid jobs. (2) Tell me immediately how to qualify for one of these jobs.

Name .....

Address .....

Editor's Workbench Chips

[*Continued from page 25*]

and get busy. Afterwards, you might have your wife or youngster snap a picture of you riding happily along on your new velocipede. Send it in to us, and don't forget to tell us how wonderful we are. . . .

Aviation Dictionary

ONE of the most interesting books on aviation we've seen for some time in Assan Jordanoff's new *Illustrated Aviation Dictionary*, published by Harper & Brothers, New York. Starting with "Ace" and winding up with "You've had it," it covers every imaginable term and slang phrase used in aviation and illustrates each item. It's our best bet of the month for flying fans.

Jeep, Jeep!

NOTHING has caught the imagination of Americans in recent years more than the Army Jeep. In advertisements, movies, magazines, newspapers and on the air the Jeep has been described, dissected, photographed, eulogized and promised as a post-war legacy to the public. When the last gun has stopped firing the Jeep will probably alter completely the face and living habits of the U. S. On the highway, on the farm, on the campus and in the garages of the nation it will be Jeep, Jeep, Jeep. And not without good reason. For the Jeep is as revolutionary a vehicle as the first Model A Ford (or should we say Model T Ford?) and has proved that it has everything any motorist could want except comfort. Maybe they'll even find a way to build that in, too. If not, who cares?

The Jeep, mind you, has what it takes. Speed, stamina, economy, four-wheel drive, power aplenty, and best of all, you don't even have to stay on the road with it. If you get bored with the signboards, or a man on a motorcycle is following you, off she goes into the woods, across the fields or downstream. Makes no difference to a Jeep. Think of the fun the farmer's daughter could have with her father's Jeep. She could plow the field in the morning, go to market with a load of vegetables in the afternoon, then home, change her dress and zip over to the dance at Crestville.

The moral of all this is—why wait until after the war for your Jeep? Of course, you'll have to if you want a stock job, but next month's issue of MI will contain plans and instructions for building the next best thing to a Willys. It's a nifty little 3-wheel job utilizing materials that you can locate without treading on any priorities. Holds two passengers or one passenger and groceries, without crowding. If you have an old washing machine o lawn mower motor lying around you're all fixe for power. The original car was built by an auto mechanic and repairman, and has been in use fo several months. Works like a charm. Be sure not to miss this in your April MECHANIX ILLUSTRATED

When Answering Advertisements, P

HOW YOU CAN BUILD A MIGHTY ARM

THIS BOOK Shows You HOW TO BUILD A MIGHTY ARM AND 16-in. BICEPS ONLY 25¢ TO YOU

A COMPLETE PICTURE COURSE ON ARM BUILDING

Why not get an arm of might with the power and grip to obey your physical desires? Weaklings whose arms were scrawny pieces of skin and bone have taken this course and in a short time developed themselves into strong men of powerful proportions with bulging biceps and brawny forearms . . . strong, solid arms of power that are respected my men and admired by women.

Learn The WORLD'S GREAT SECRETS OF ARM STRENGTH

This course is especially planned to build every muscle in your arm. Many pupils have developed a pair of triceps shaped like a horseshoe, and just as strong, and a pair of biceps that show their double head formation. The sinewy cables between the biceps and elbow are deep and thick with wire cable-like ligaments. The forearm bellies with bulk, the great supinator lifting muscles become a column of power, and their wrists are alive and writhe with cordy sinew. Wouldn't you like to have a magnificent arm like the figure pictured above?

You can't make a mistake. The strongest armed man in the world wrote this course for you. His great experience stands as proof that you too can succeed. You get his secret methods of strength [illegible] illustrated and explained as you like them. Rush on[illegible]

SEND $1 FOR ALL 5 [illegible]

FORMERLY SOLD FOR $5 EACH. Y[illegible] any one of the courses listed in[illegible] them for only $1.00.

Mail your order now [illegible] will be included F[illegible] muscle builder, [illegible] show you what [illegible] them and ho[illegible]

WIN THE WAR!

By W. H. FAWCETT, Jr., PRESIDENT

MECHANIX ILLUSTRATED

The head of my local civilian defense office told me the other day that, every time the United Nations score a decisive victory, the registrations for volunteer defense work fall off so badly he's ashamed to release the figure to the newspapers! To me, this information is astounding! Do people really believe, do you suppose, that one or two victories will win the war? Do they think Hitler or Tojo is going to collapse because of an Axis defeat in Africa or the Solomons?

Uncle Sam says no! Our military leaders state that when we let down—even for a moment!—we postpone the day of final victory for just twice as long! So I hope none of my readers has been lulled into relaxation by these occasional successes. Remember, we all want to get the war over *quickly*—and we're going to do it, too!

Meats, fats and dairy products, according to the OWI, are the commodities desired above all others by our fighting forces and by our Allies. Accordingly, you can do a real soldier's job on the home-front by denying yourselves these war-time luxuries, even when you see them for sale or when you're entitled to them under rationing. If you want to help win the war, your government says, you'll concentrate on such foods as liver, brains, kidneys, fresh fruits and [illegible]**oultry and game. *What* we** [illegible]**fact is we're eating! ... can say.**

... to time,

A businessman friend—and not a wealthy one either!—was moaning because they'd let him buy only $5,000 worth of the Series E War Bonds in a year and he'd already bought his share for this year!

Have any of your friends made a similar complaint? They should.

The OWI, which has investigated some 5,000 rumors floating around the country since Pearl Harbor, has asked me to pass along to you a few rules about how to handle a rumor when you hear one.

Briefly, here's what you're supposed to do.

1. *Never* repeat a rumor.
2. Don't repeat a rumor even to deny it.
3. If you know the facts that will spike a rumor, cite those facts *promptly*.
4. If you don't know facts to spike a rumor, ask the rumor-monger where he got *his* facts.
5. Don't give a rumor the benefit of any doubt.

President Roosevelt officially has designated March as "Red Cross Month"—and I think that should be enough said. We all know the work the Red Cross is doing, especially in the way of war work, and the only way it can keep up this program is through your generosity. The goal set for the month is $100,000,000, or about a quarter of the Red Cross total for World War I. It's a lot of money, but Americans have never been pikers before and I'm willing to bet they're not going to be this time.

You hear them every day. "Fuel oil rationing doesn't affect us," they say. "We burn coal."

But what these folks don't seem to realize is that coal is a war fuel too and, though we have plenty of it in the United States, we don't have an oversupply—and every extra ton we have is needed in the war effort, so badly needed that Luther Harr, United States Bituminous Coal Consumers' Counsel, recently offered this slogan for all home owners:

"Save a shovelful of coal a day."

W. H. Fawcett, Jr.

How I Kill Nazis at Night

by Flt. Lt. Karel Kuttelwascher

World's Greatest Night Fighter Pilot

I HAVE been asked to tell something about myself and my experiences with the Royal Air Force. It is a request with which I am more than happy to comply, not only for the interest it may hold for my countrymen, but also for the information of those American readers who may not realize how Czechoslovakia-in-exile is fighting still against Axis domination. Except for differences in detail, my story is the story of thousands who are waging on Nazism the war that can end only with complete victory for freedom loving people.

I like my English comrades of the R.A.F. and they appear to like me. They have friendly nicknames for me. Because I am inclined to be serious and quiet, they call me "Old Kuttel." More amusingly, they sometimes call me "Cat-eyes" because of my reputed ability to see in the dark. That is nonsense, of course; it is merely a fable that grew out of circumstances I will presently explain.

However, aside from all that, until I have squared a few accounts with the enemies of my country, nothing will quite eradicate the bitterness I feel when I remember the morning the German invaders took possession of our flying field in Czechoslovakia. It was March 15, 1939, a never-to-be-forgotten date in the history of my people.

On that day I saw for the first time a German Dornier equipped for battle. Six of them flew in and took over our air-

Flight Lieutenant Kuttelwascher, a Czechoslovak by birth, has been a member of the famous International Squadron 1 of the R.A.F. since he made his way to England after the fall of France. His decorations include the Czechoslovak Military Cross with second and third bar; the Czechoslovak Medal for Gallantry, with bar; the French Croix de Guerre, three times; and the British Distinguished Flying Cross. His score, as he gave this first-person account of his experiences to Cecil Carnes, was 21 Axis planes.

Somewhere in England, at night, a control officer *(left)* signals for a night fighter to come in while an operator lights the "owl's" way with a glide path indicator.

drome! There was no time for flight, no opportunity for action. You can imagine our feelings!

The Germans confined us to the premises and watched us closely. In return, I studied their planes till I was certain I would recognize one wherever I met it. When we were finally released and free to go to our homes, there was a real significance in our parting: "I'll be seeing you!" That went not only for my comrades, but for the Germans *and* their Dorniers as well!

I escaped from occupied Czechoslovakia, needless to say without the formality of a passport or German permission. I traveled to Poland in a freight car filled with coal. Accompanied by my brother Jan and several other young men like us, I sailed for France in a ship engaged by Czechoslovak officers already in the West.

Continued
How I Kill Nazis at Night

In France, war had been declared. I was given a pursuit plane—a Bloch. Arrived at the front, I spent the night in an abandoned automobile on the edge of a flying field, and in the morning I was off to an early start.

The first enemy plane I encountered was a Dornier!

My ship was the faster and more maneuverable, I knew. I did not open fire at once. I wanted to inspect my intended victim, and did so from all sides, flying around him in leisurely circles. Then I passed directly under him, which came close to being a costly error. Apparently he had just arrived above his objective, for suddenly he let go his bombs. I had barely time to swing away before they went screaming past me—any one of them capable of breaking my ship to pieces.

I went up fast, taking the fire of his guns as I passed him. Luckily, I wasn't hit. Flying over him—I gave him all I had. He went plunging toward the earth and I lost sight of him. Three days later one of our non-commissioned officers brought me the cap which the pilot of "my" Dornier had been wearing.

A British night fighter sharpens its teeth preparatory to going aloft, firing bursts of tracer bullets to check the alignment of its deadly wing armament.

That was the second occasion on which I met a Dornier. A most satisfactory affair.

First and last, I fought air battles over the whole length of the French front, having rather more than my share of luck in bagging specimens of the *Luftwaffe*. I rolled up a very decent score.

And had some narrow escapes. Once I was attacked by a large group of Messerschmitts; they came for me like a cloud of blood-thirsty mosquitoes and my life expectancy at that instant was a bit on the short side. I slammed away at them till my ammunition gave out, then tried hopefully to escape by sliding into a cloudbank. I emerged from its other end to find them already there and waiting for me.

Not so good. Back into the clouds again. A long wait, and once more I nosed out. They were still there, circling patiently and waiting for me. Quite obviously they meant to get me even if it meant being late to their supper.

I had to get the better of them, somehow. Desperately, I put my plane into a tailspin and plunged earthward in crazy spirals. The almost childish ruse succeeded. The Germans thought they had done for me and turned away. Headed for home, they never saw me straighten out and make a bee-line for our base. I had a good laugh over that.

The military situation in France grew rapidly worse and soon it was clear to everyone that the end was at hand. I was obliged to turn in my plane. Safety lay to the south, and with a few comrades I turned in that direction.

We managed to reach a town in Southern France where there was a big airplane factory. We tried unsuccessfully to persuade them to give us a plane. Then we met a high officer of the French Army who exclaimed: "What are *you* doing here? You must be away by six tomorrow morning at the latest!" He took us back to the factory and suddenly, miraculously, a plane was placed at our disposal.

We made the African coast on our last gallon of gas. There all went well till the unhappy affair of Oran, when the English fired on the French fleet after its refusal to surrender. The French asked us to fly against the British planes. We refused, firmly. From

At a British-Czechoslovak Friendship Rally in London, Flight Lieut. Kuttelwascher writes autographs for eager British boys.

that moment we were *persona non grata* on any French air-field, and perhaps fortunate to escape imprisonment.

The atmosphere was too sultry for comfort. We pulled out discreetly and managed to make our way to Casablanca, first, then to Gibraltar. At last—English soil! It was easy then to reach England, new planes, and new action against the common enemy.

One small exasperation now fretted me. The English are very careful, very strict—justly so, of course. While the Battle of Britain raged, and despite my record as a fighter pilot, I was not allowed to go up till I had completed the training course which the R.A.F. imposes on all newly-joined pilots whatever their outside experience may have been.

The training ended, they gave me a plane and inducted me into the now famous International Squadron 1. Our Commander was, and still is, "One-arm" MacLachlan.

He is a wonderful fellow, this MacLachlan, and a very good friend of mine. He had an arm shot off in a dog fight over Malta and had to bail out from 20,000 feet. And—imagine!—three weeks later he was flying again. He is my companion often on night trips over the Channel and the rivalry between us is no less keen than friendly.

After my period of enforced inactivity, dating from the time I left stricken France, it was wonderful to be in the air again with a splendid new ship beneath me. I was a caged bird suddenly set free. The R.A.F. had no happier flier that morning.

You will remember the first plane I shot down in France was a Dornier. Now history repeated itself and the first I caught in England was a Dornier. One might think I was haunted by the things, for of the last 22 planes I have bagged, the great majority were Dorniers. Never in my life have I spoken more prophetically than that afternoon in Czechoslovakia when I told those six invading brutes I'd be seeing them again. I would love to think that among those I've knocked out of the air were some of the original half-dozen!

I had a little success at the start—enough so that the English elected to give me a special course in night fighting. They trained me long and carefully, and when they decided I was qualified for the work they assigned me to the job of going up at night to meet and attack the enemy. German bombers were coming across quite frequently; it was after the British raids upon Lubeck and Rostock and the infuriated Nazis were planning, in retaliation, to bomb every English town marked with a star in Baedeker.

It was then my real fun began.

I had gone up one night in response to an alarm and was hunting for the raiders. I had no luck, but presently I had an idea.

"It's hard to get these fellows in the air on such dark nights," I reflected, "but they have to take off and land; that might be a good moment to catch them."

Promptly, I turned my ship and flew over the Channel to the neighborhood of a German air field. Keeping high, I circled the unsuspecting drome for some little time, hoping something would come my way before depleted gas tanks would force me to leave.

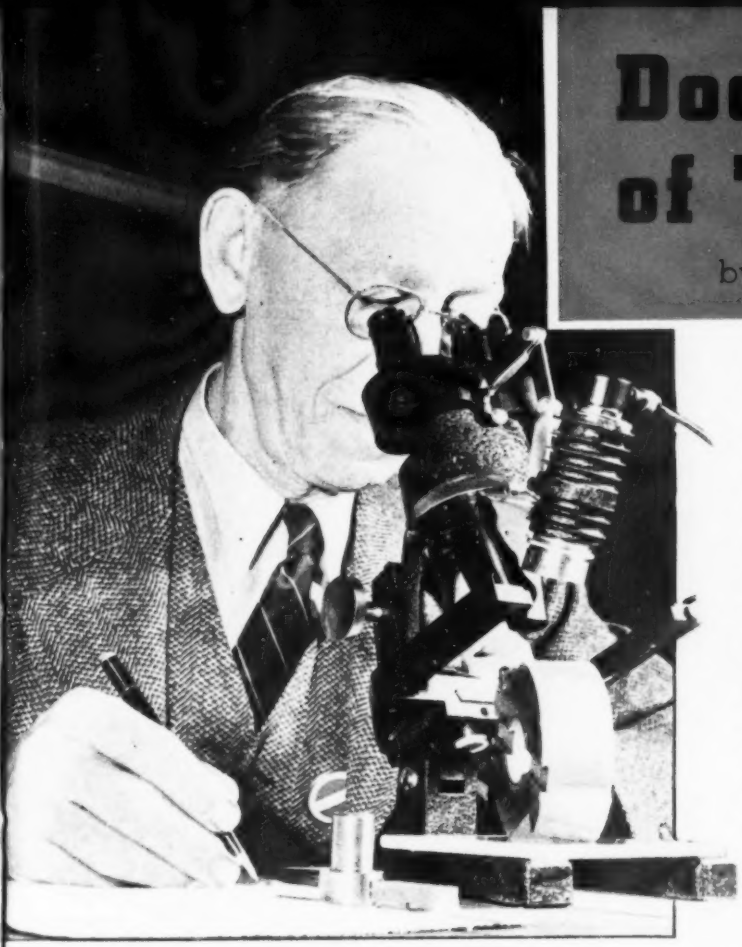
I was lucky. Several bombers came roaring in, returning from the raid. I spotted them, descended and followed. If they saw me at [*Continued on page* 160]

Continued

How I Kill Nazis at Night

Doctor of Tools

by Cecil Carnes



A unique genius is Arthur Schwartz. He is employed by the Bell Aircraft Co., for one reason only: To design miracle tools when they are needed quickly!

BEHIND the miracle of America's lop-sided score against its enemies in the air is the miracle of America's superb fighter planes. Behind this miracle is the miracle of American production of these fighter planes. But the final miracle of all is a little known man, a man who has received no medals or accolades: the American tool designer.

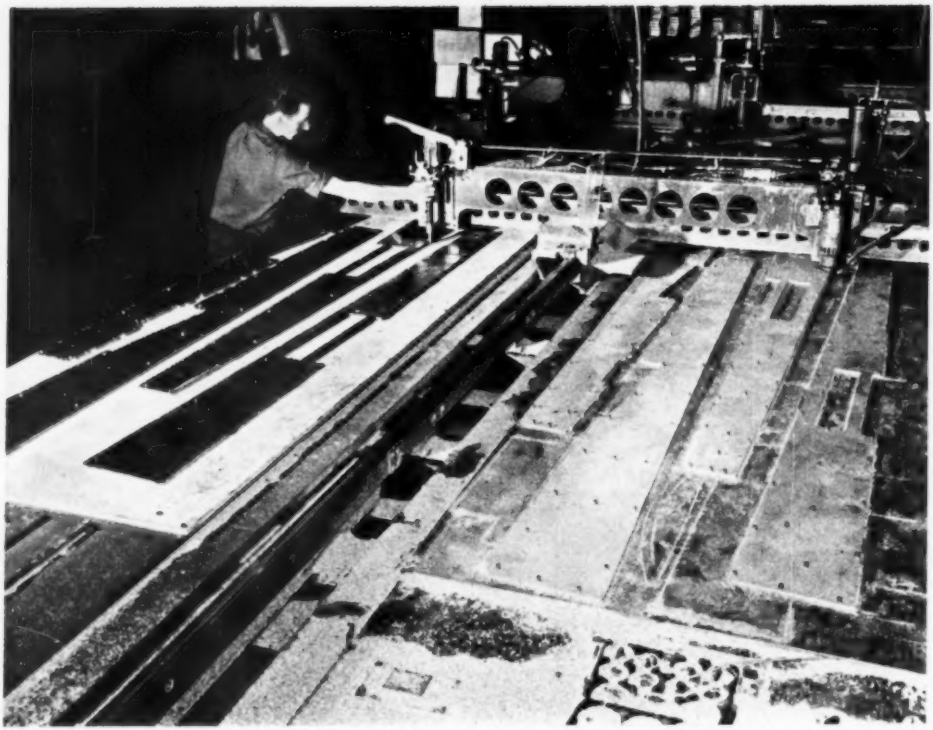
When, soon after Pearl Harbor, President Roosevelt called for production of 50,000 planes a year, the world said, "Ridiculous! It can't be done!" Today, it is being done. And it is being done solely because of the genius of a small group of men in America—not more than two dozen of them, altogether. They are America's Doctors of Tools. Without these unique American geniuses, no such production record could ever have been attained.

One of them—perhaps America's greatest Doctor of Tools—is Arthur Schwartz. Arthur Schwartz is employed by the Bell Aircraft Co. for one duty only: he sits in his office and performs unheard of magic with tools. He may sit for days or weeks in his office without being given any special assignment. Then the production manager may come to him and say:

"Art, we have to have a machine that makes rivets faster. We're turning out Airacobras fast enough, but we're not turning out rivets to hold them together fast enough. Make us a machine that will do it."

As a matter of fact, that is one of the actual problems with which Arthur Schwartz was confronted recently. The Airacobra consists of thousands of separate parts. And it requires 90,000 rivets to hold those parts together! Not long ago, parts for the Airacobra were being turned out faster than rivets could be produced to hold them together. So the problem was placed in Arthur Schwartz' lap. In a few days time, he designed a machine that now is manufacturing more than 360,000 rivets in 24 hours!

The machine literally "eats" giant spools of special alloy wire, and spits out rivets. It works with such accuracy despite its speed that only 2/100 of the total number of rivets



One of "Doctor" Schwartz' special creations is this pantagraph router, to cut accurate parts from stacks of aluminum. While the workman traces, the machine cuts.

it makes are rejected! That's some improvement over the old figure of ⅛ rejected. Moreover, it makes them at only a trifle more than half the price they'd cost if they were bought. And that's merely one illustration of the way Arthur Schwartz' plane-building machines give us more victories per dollar.

Another of his machines turns out the Airacobra's spar caps. These are among the structural members that enable the Airacobra's wing to pull up in one piece after chasing the wings off the enemy. The machine starts out with a fairly rough metal beam, and mills it down to the exact proportions the wing designer planned. A long procession of clamps hold the cap, or beam, in place while a whirling cutter travels its full length. As the cutter reaches each clamp, the clamp pops back out of the way. The instant the cutting head passes, the clamp jumps back into position, holding the spar cap firmly in place so the next clamp can hop out of the way. Pretty smart for a machine, eh?—And it cuts the cost from $175 to $8.50 per unit.

Another piece of Schwartz' tool designing magic is the pantagraph router that he developed to mass-produce more complicated parts for Bell's mighty sky fighter. This mechanical-brained gadget, incidentally, sprang full-fledged from Schwartz' mind. Guided by a template, it turns out a dozen parts at a time, and drills rivet holes. In case you're wondering what a template is, it's a piece of material the same shape as the part to be reproduced. The pantagraph router has a little guide on it that travels along the edges of this "dummy" and moves a device that cuts a whole stack of sheet aluminum to exactly the same shape!

The leading edge of the Airacobra wing was one more tool design problem that this master designer solved. You probably know that the leading edge of any plane's wing does the major part of the lifting job, and so has to be

Continued

Doctor of Tools

just right. Schwartz knew it too, when he developed the machine that rolls out leading edges for the Airacobra—starting with plain flat tapered sheets of metal. And it does it fast!

With such a record of technical achievement, you might suppose that Arthur Schwartz spent most of his early life in schools and universities. You might think of him as a bit on the stodgy side, thinking always of formulas and mathematical nightmares, but that's where you're wrong.

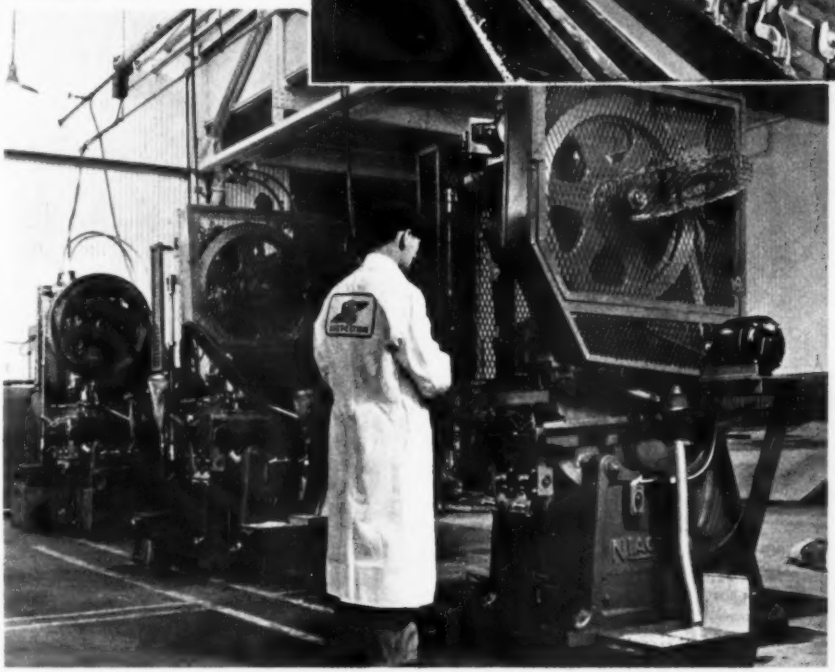
Believe it or not, his early schooling was of the home-tutoring variety, as the nearest school was 12 miles away. He followed it up with a couple of years at a semi-high school and a short course at the South Dakota State Military College.

That was enough education for Schwartz. He wanted adventure, and he got it in short order. He joined the gold rush to Alaska. When he decided gold was too hard to find, he ran a sawmill. Then he installed a Government radio station at Tanana, and during the job, was shipwrecked on a sandbar, and caught in an ice jam that nearly killed everybody aboard the ship he was traveling on.

It's small wonder that he got his fill of adventure quickly, and turned to more relaxing pursuits, such as [*Continued on page* 160]

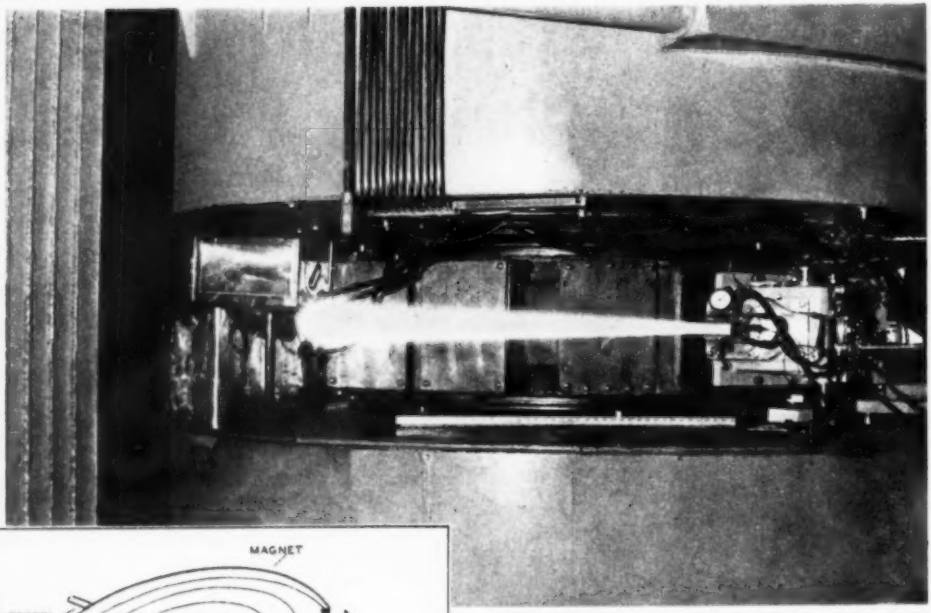
This magic tool machines the wing spar caps for P-39 Airacobras, turning them out faster than popcorn!

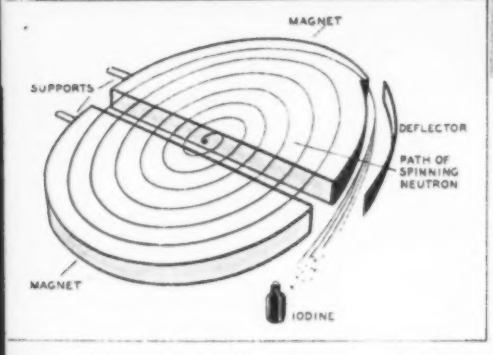
"Doctor" Schwartz is proud of the rivet machines below. One of them manufactures 360,000 rivets a day.



Exploring Life With Atomic Flares

by Ruth Ringle





Above: The source of atomic flares—a cyclotron beam, generated by atomic particles whirling at 60,000 miles a second.

Left: Diagram of a cyclotron at work. Atomic particles spiraling in magnetic field are shot out by deflector in a beam.

WHEN Dr. Ernest O. Lawrence invented the cyclotron, the scientific world unanimously hailed it as a great instrument for physicists. It could transform lead into gold; its pioneering thrusts into the unknown interior of the atom indicated that it might even some day unlock the secret of universal atomic power. But perhaps the most immediately useful ability of the cyclotron has until now gone generally unrecognized, except by a few advanced medical researchers—that is the cyclotron's power to make common substances, such as table salt and phosphorus, radioactive.

Fed to plants, insects, animals and humans, the artificially radioactive elements are harmless and can be traced through living tissues. These atomic flares are revealing many unsuspected mysteries of life, disclosing the offense tactics of disease, and furnish a new and powerful weapon to fight such malignant enemies as leukemia and cancer. Some researchers hail these cyclotron-produced

elements as the most valuable contribution to research since the discovery of the microscope.

A little phosphorus made radioactive can be added to the food of a white rat, and the animal's system cannot tell the difference between the charged phosphorus and that in its cereal. But radiations from the substance penetrate flesh and bone, and when the researcher moves an instrument sensitive to the radiations over the rat's body, the tagged element can be traced. The most commonly used detector is the Geiger Counter—a metal cylinder with a mesh opening in one end to expose a vacuum tube. When radiations from cyclotron-charged atoms within the body strike this tube, a popping sound, amplified within the Counter, can be heard. Although charged atoms emit "rays," these rays are not followed by sight but by sound.

This is a new and far more accurate way to study the mysteries of life—plant, insect and animal—in sickness and in health than any other method yet discovered. All that has been learned in the past about life processes and the attacks of disease was gained principally by a chemical analysis of body secretions of the living and chemical and microscopic study at death. It has been rather like trying to learn a manufacturing method carried on behind closed doors; materials that go in and out can be noted, and discarded machinery studied, but the actual procedures are hidden. Radioactive tracers, however, floodlight living tissues while they are at work.

Researchers found that we do not have to wait hours for the revitalizing effect of food. The lift from a good meal is more than satisfied hunger, for food is quickly transformed into fitness. Salt sprinkled on a breakfast egg does not linger in the stomach, for an efficient and rapid processing and transportation system assimilates the salt and carries it to fingers and other distant parts within two minutes. If the salt is iodized, that iodine reaches the thyroid gland a few seconds after it is eaten, and half an hour later, mixed by the thyroid into an energy-stimulating hormone, thyroxin, has spread to nearly every part of the body.

Through radioactive tracers doctors have learned much about the use and value of medicine. Anemia, for example, is one of the most widespread deficiency diseases, sapping vitality and lowering resistance to infection. Doctors knew that lack of iron caused anemia, but they did not know just how much was needed for health, and large doses were often prescribed for "run down" patients. Radioactive iron fed to animals was traced to bone marrow where it was mixed into red corpuscles. They discovered, though, that the body uses a measured amount of iron, and that unless blood tests show an anemic condition, large doses of iron in yeast tablets,

Above: The vital thyroid gland, illuminated for study by radioactive iodine prepared in cyclotron.

Right: Lead-impregnated mask and gloves guard this laboratory worker on the cyclotron from radiations.

Apparatus showing how radioactive salts inside a mouse are detected. Machine clicks when radioactive mouse passes by.

tonics, or even in plates full of liver and spinach will not "build up the blood." The excess is discarded, unused. But if there is anemia, the body greedily absorbs iron until the blood is built to normal, then refuses to take extra doses.

Cobalt, an essential to good steel making, also improves the mettle of man. Scientists knew the body used some of the metal, but did not know where or how much. Radioactive cobalt was traced to the liver, spleen and kidneys, but most of it was taken up the pancreas, suggesting that cobalt, found in cereal foods, has something to do with the production of insulin, the lack of which causes diabetes.

Some revolutionary discoveries about the way teeth grow and survive have resulted from tracing radioactive phosphorus to these bony structures. It has always been assumed that teeth were static and never change, unless to decay, that when adult teeth replaced baby teeth, they had to be accepted as they were, for better or worse, until death or extraction ended their usefulness. Other body tissues were nourished and renewed, biologists believed, but not the teeth. Radioactive phosphorus disproved this supposition. Fed to test animals with their food, it was traced to both molars and incisors, showing that teeth are nourished and renewed as are other body tissues.

This discovery is a clue to the cause and treatment of dental defects. The dentist of tomorrow may halt decay by increasing the supply of tooth-building phosphorus and calcium to dental tissues, either by adding more of the substances to the diet or by correcting poor assimilation.

The popular belief that mothers sacrifice their teeth in child-bearing may be true. Radioactive calcium fed to pregnant mice was traced first to the mother's bones and teeth. Just before birth, however, calcium was drained from the mother and migrated to the infant's skeleton. Wise doctors have long urged expectant mothers to drink extra milk, best source of calcium, and this discovery emphasizes the worth of such advice.

Dr. John H. Lawrence, brother of the cyclotron inventor, physician-professor

This is what makes the machine at upper left click in response to radioactivity—a Geiger Counter, for tracing "tagged" atoms, the radiations from which are amplified by it and noted by meter.

Right: Close-up of an oxygen atom. A cyclotron beam, penetrating to the nucleus, changes the atom's structure or makes it radioactive.

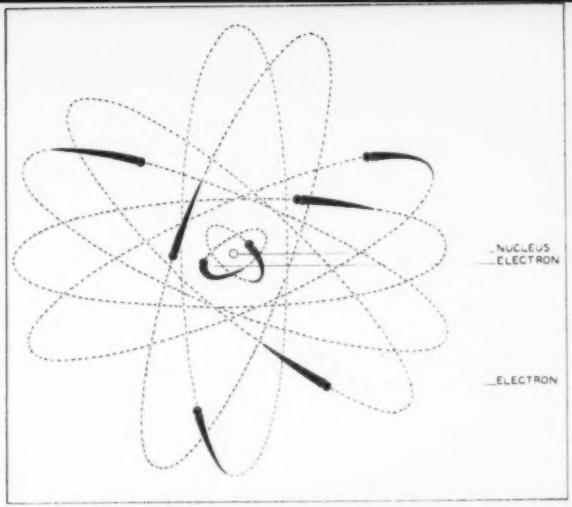
in the University of California Medical School and director of biological and medical research of the radiation laboratory, is very conservative when talking about the value of radioactive elements in the treatment of disease. The few years of clinical tests, though, have brought considerable success and great promise.

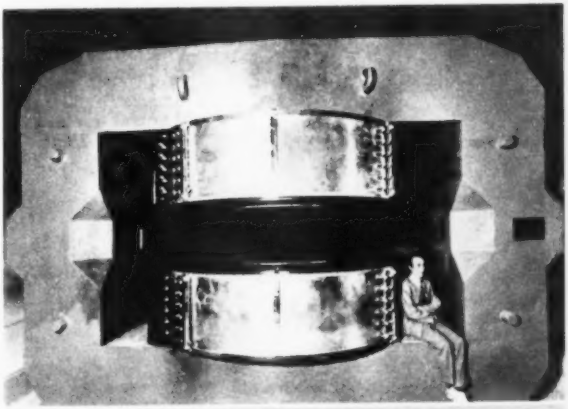
The fact that elements are predominantly selected by certain body tissues, as iodine is by the thyroid gland, for instance, and calcium by the bones, suggested that radioactive atoms of these substances might be used to treat abnormal conditions by direct radiation of the cells, replacing radium and X-ray therapy.

A patient with bone tumor may be given harmless amounts of radioactive phosphorus. Carried by the blood directly to the bone, the charged phosphorus radiations act on the bone tumor in the same cell-destroying manner as radium and X-rays, but do not harm normal tissue.

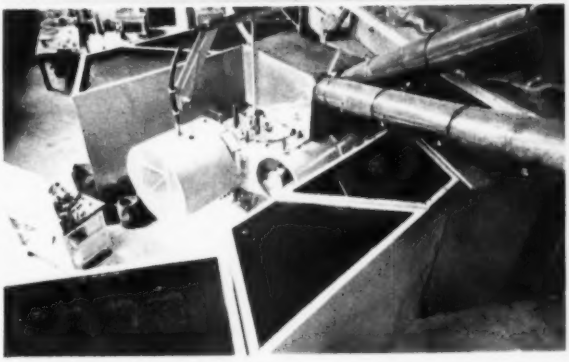
Tests with mice show that abnormal tissues, such as tumors and cancers, absorb more radioactive phosphorus than normal cells, and this concentration in abnormal cells speeds their destruction by radiation. The reason for the phosphorus greed of tumor cells is not merely a peculiarity, but is probably due to the fact that abnormal cells are rapidly multiplying *new* cells, and phosphorus is used in large amounts to produce all new cells.

There are two blood diseases, fatal to thousands of people each year, which doctors have been unable to cure. In one, leukemia, the number of white corpuscles in the blood multiply like fungi in stagnant water, and eventually fill the blood stream and accumulate in liver, kidneys and spleen until these organs become clogged and enlarged. In the other, polycythemia, [*Continued on page* 178]





Above: The coils of a cyclotron in place on the magnet core. Three coils can generate in a vacuum chamber set between them atomic velocities equal to those obtainable in a 17,000,000 volt vacuum tube.

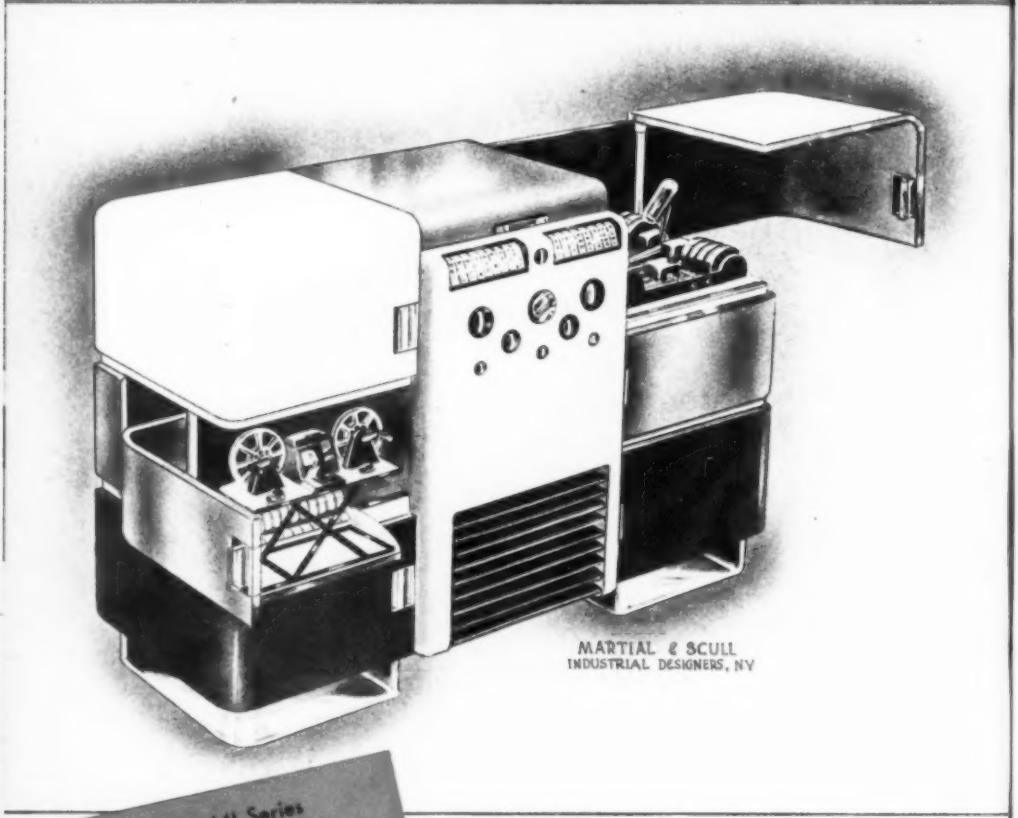


Walls of concrete and water five feet thick imprison the cyclotron's powerful radiation. Cyclotron's controls are located in another part of the building.

THE POST-WAR RADIO

by Donald G. Cooley

Radio designed by Martial & Scull, industrial designers, New York



Sixth in the MI Series
"A WORLD YOU NEVER KNEW"

The magic home theater that may be yours after the war. In this one cabinet are radio, television, movies, phonograph "records" on film sound track, "focused beam" speaker, automatic program selector, etc.

"WELL, darling," you remark to Her, "what do you say to moonlight and roses tonight?"

This would seem to take a bit of doing. Outdoors, the moon is hidden behind dark clouds and the rose bushes in the garden lie under two feet of snow.

So you decide to bring the moon up from the South Seas and pin it on a wall of the living room. Beside the davenport sits an inconspicuous cabinet about half the size of a small desk. It has a shimmering plastic surface of a color to harmonize with the furnishings. You slide open a disappearing panel, disclosing a dozen knobs and dials, and after a moment's study you twist one of these.

"Oh, isn't it beautiful!" sighs the young lady soulfully.

It *is* beautiful. She is referring to the full-size scene that has suddenly come alive on a wall of the room (opposite the sofa, of course).

Golden moonlight filters through dark palm tree fronds. Yellow moonbeams dance and shimmer on the green and purple ripples of a warm tropic sea. A red canoe glides into the scene and you hear water dripping from the orange paddle held by a young man who croons romantically to a girl propped up by brightly colored cushions.

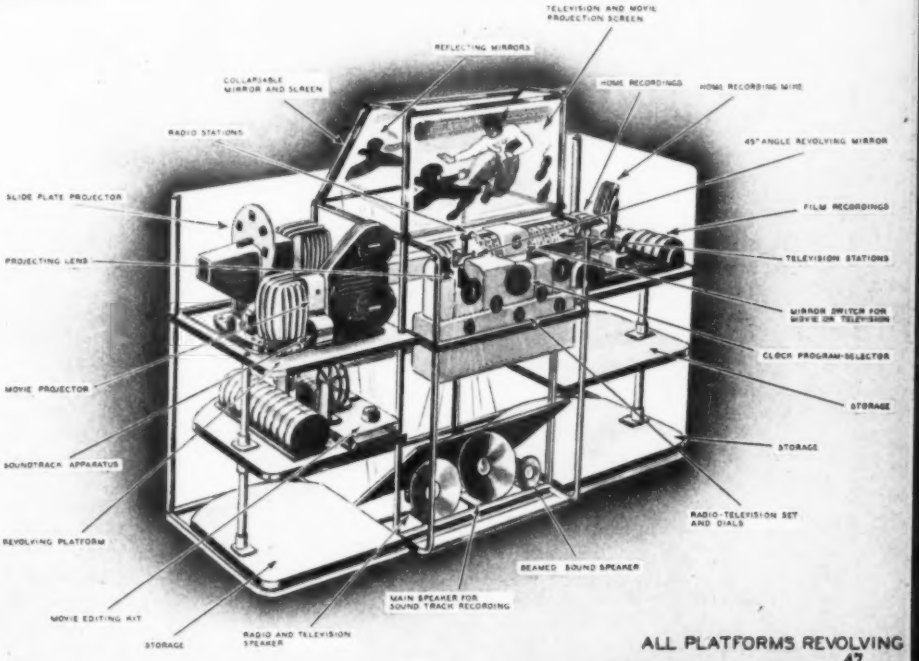
What is it—a movie with sound effects projected from that small plastic cabinet? No, it's actual moonlight, actual palm trees, actual singers, brought right into the room by the marvel of television. What you see on the wall is actually taking place hundreds or thousands of miles away. Perhaps the scene comes from Tahiti, or Florida, or Cuba, or Mexico—you have the whole world at your fingertips.

Suppose the young lady has invited you to a home-cooked dinner. As you sit at the table, an entire wall of the dining room suddenly becomes Niagara Falls. You hear the dull roar of water tumbling over the brink, watch a river boat scuttle in and out of the mists. Maybe you'd rather let some floor-show cuties entertain you to the accompaniment of your favorite orchestra. Or, in a more quiet vein, you can watch the brilliantly colored Grand Canyon stretching illimitably away from you, as if the wall had opened up into all outdoors.

What wonders come out of that small cabinet in the living room! Tiny as it is, it prints a tabloid newspaper, brings photographs and cartoons, remembers to turn itself on when you want it to, writes your letters, reads your books, carries you to the scene of news events while they are happening, broadcasts radio programs that are marvelously clear to you, yet totally inaudible to Grandpa reading his paper a few feet away—stores up news events so you can see and hear them at your leisure, plays symphonic or rug-cutting music for 20 hours at a stretch from a tiny film roll no larger than your hand, and delivers other miracles.

That's the marvelous kind of home entertainment you're going to have in the post-war world, the world we are fighting for. Not overnight, of course, but sooner than you think; for the war itself has speeded many secret researches and the technical means of accomplishing most of the wonders we have described are already perfected. Best of all, that small electronic wonder-cabinet will be

How your post-war radio will operate, reflecting mirrors are used to project three-dimensional movie and television images in color.



ALL PLATFORMS REVOLVING

well within your pocketbook range, no more expensive than a good radio set is today.

Let's view the imminent new miracles of that magic box one at a time. To begin with, there's television. Forget your idea of television as a flickering black and white or greenish image a foot square. These images will be much larger and, as research advances, will in time be as big as a wall if you wish. Remember the early movies (the nickelodeons) where you plastered your eye to a lens and saw a moving image a few inches wide? In spite of the more complex problems involved, television is some day going to overcome the handicap of small size too.

Even if the television sets immediately after the war won't cover a wall with their projections, you're practically certain to see large-size images in natural color, astonishingly true to life. The Columbia Broadcasting System has already broadcast television programs in color. John Logie Baird, the British television pioneer, has a set ready for release after the war that not only receives three-color images but shows them in three dimensions as well. The pictures will have depth, actors will have substance and you'll instinctively duck when a motorcycle comes at you from the screen.

Problems of "canning" televised programs and news events so that you can store them

Continued
The Post-War Radio

Tropical moonlight to order in your living room, is easy to get with three-dimensional color television.

up and view them at your leisure are well within the range of technical probability. You can have a whole library of moonlight scenes to be viewed as often as you wish. Instead of hanging pictures on the wall, it will be entirely possible to have living, moving pictures, changed as often as you wish. What a field day for interior decorators!

You won't always want oversize television images. Engineers foresee the day when you can hold a personal television screen, no bigger than a book, in your hand. Take it with you to the kitchen, the bedroom, or prop it on the workbench while you cut a jigsaw puzzle.

Coming methods of reproducing sounds are startling, too. Imagine the sensation of hearing a bee buzz out of your radio set and fly right over your head. Watch a televised football game and you'll hear the referee's whistle blowing on the 50-yard line instead of on the loudspeaker as it now seems to do. Watch a symphony orchestra and you'll hear the bass viol at one end of the group, the drums at the other, instead of one general mass of sound. Like vision, sound will be given a third dimension too.

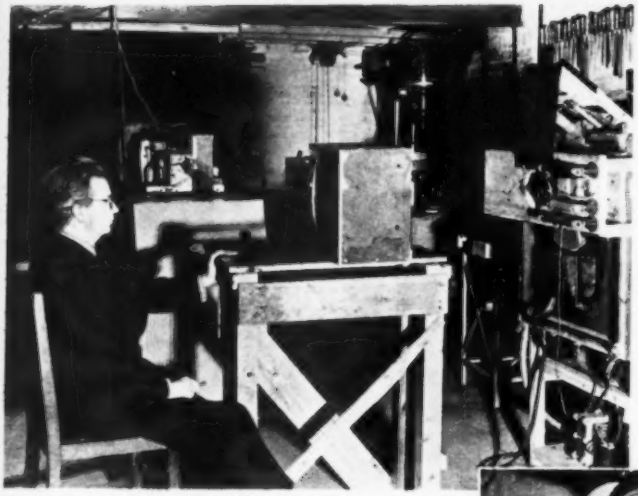
And it will be so true to life that, if you close your eyes, you cannot distinguish between a speaker in the room with you and a speaker's voice coming over your receiver. FM or Frequency Modulation radio is destined to become much more popular, not only because of its amazing fidelity but because static and man-made interference—the annoying buzz, hiss hum and crackle that often disturb reception—are eliminated.

Ever have family arguments because Johnny wants to tune in the Lone Ranger just when you prefer to sit quietly reading your paper? Let him listen to his program; you can sit a few feet away and not hear a word of it.

Uncanny, yes, but no mystery to radio engineers. Light, heat, and sound are merely different forms of the same phenomenon: wave motion. The difference comes mainly in the length of the waves. Researchers have been coming up with some important discoveries about the wavelength territorites between heat and radio waves. Certain of these frequencies have some of the characteristics of light. Notably, they can be focused into beams, like the rays from a flashlight.

So, applied to a radio set, we have sound waves traveling over these beams. Johnny hears his program because he's sitting in the beam. You don't hear it because you're outside the boundary, just as you might be in darkness although a pencil of light streaks past you a few feet away. In fact, if you have two such radios, in the same room, you can hear one program while Johnny hears his, and neither will interfere with the other. Applications of this sound-focusing principle are now being used in secret methods of signaling to and guiding planes and ships.

No doubt you have often berated yourself



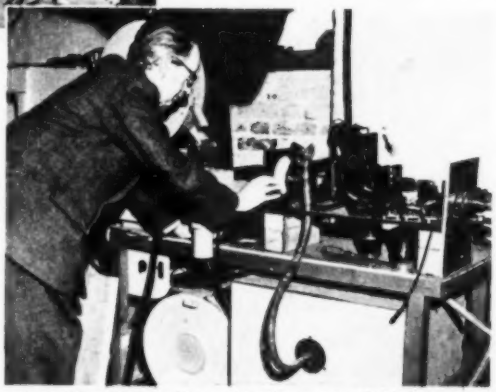
Above, John Logie Baird, Scottish television pioneer, with his newly-developed device for transmitting and receiving three-dimensional television images in full color.

for failing to tune in some radio program you particularly wanted to hear. Your new set will remember for you. Just set a radio alarm clock when you get up in the morning. This will be a simple form of set attachment by which you choose the wavelengths and hours of coming programs. The set goes on automatically, turns itself off when the program is finished, and is silent until your next favorite hits the air waves.

Another adaptation that already is of wartime importance is a device whereby your radio could be turned on by the broadcasting station. At present such a gadget is used for the reception of private air raid signals by wardens. The device, no larger than a saucer, is operated from a control board at a central power station. It is no great step forward to hook a similar instrument to the home radio. It could turn on a set, or ring a bell, or flash lights of various colors to indicate the nature of important announcements. Thus, with your permission, such things as important news flashes would reach you even though you didn't know they were coming.

But not all the news from that electronic cabinet will be audible. You turn on a switch when you go to bed. While you sleep, the instrument is quietly printing tabloid news dispatches. When you get up in the morning you detach a paper sheet from a roll and you have a condensed newspaper hot off the press. A large Midwestern newspaper has, in fact, offered such a service to customers since 1939.

Not only printed matter but cartoons and photographs can be delivered by your cabinet. This is just an extension of radio facsimile—the process by which photographs are radioed from England or Russia or China and received in this country much more swiftly than the fastest plane could carry them.



Mr. Baird checks over his new television receiver in his laboratory. Is said to be already perfected, ready to go into production.

We've almost forgotten that your cabinet is a phonograph too—but such a phonograph as you have never laid eyes on. Examine it closely as you will, you cannot find a single record disk, a turntable, a playing arm or needle. Instead, [*Continued on page* 174]

Continued

The Post-War Radio

ELECTRONICS

The Science of Tomorrow

Aladdin's lamp was a poor makeshift compared to the new science of electronics. Electronics produces magic such as you never dreamed of. It will be the true key to "A WORLD YOU NEVER KNEW" which is coming after the war. Be sure to read Don Cooley's fascinating article on it in next month's MI!

but here is one worry you can avoid

UNCLE SAM needs YOU in your war-job . . . whatever it may be. Equally important, he needs you on the job *all* day, *every* day.

That means you've got to keep your *car* on the job too . . . ready to get you to work on schedule! So stop car troubles *before* they start. Avoid excess chassis wear with Marfak lubrication.

Marfak helps add miles to your car's life by *cushioning* king pins, tie rods, drag links and other vital friction points. Marfak especially resists the washing-out effect of snow, slush and rain. It's super-tough. It "stays put."

To insure *worry-free* protection, Marfak is applied by chart, not by chance!

Never say "grease-job." Insist on genuine Marfak 40-point Lubrication Service. At Texaco and other good dealers everywhere.

TEXACO

Let us MARFAK your car

CHASSIS LUBRICATION SERVICE

For Your Enjoyment . . . 2 Great Radio Programs

FRED ALLEN: On the air every Sunday night, Columbia Network.

METROPOLITAN OPERA: Complete broadcasts of great operas every Saturday afternoon, Blue Network.

You're Welcome at **TEXACO DEALERS**

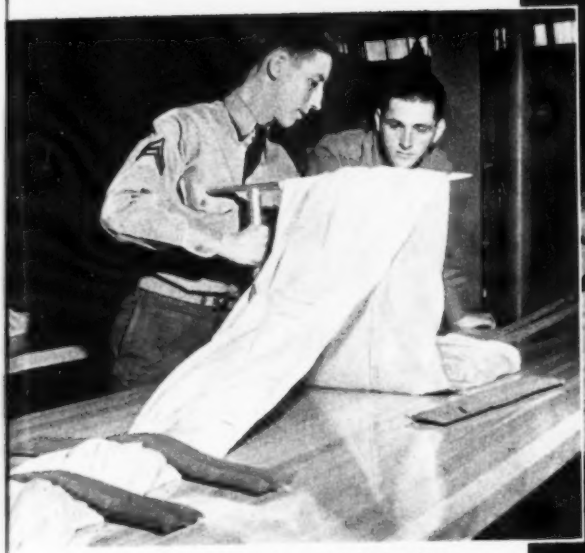
HOW PARACHUTES ARE PACKED

Photos by
Harold W. Kulick

ON THESE pages are shown steps in one job which every paratrooper and airman must learn to do with absolute perfection, for anything less than perfection will cost him his life; it is the job of packing his parachute. A 'chute must be packed so that the ripcord pulls properly; so that the shroudlines cannot tangle; so that the chute itself will unfold and spread easily and fast. Each man must pack his own.

Left: A good job proves itself. This soldier scores 100% in a test in which anything less is fatally flunking.

1. An early stage in the packing process. Note the meticulously polished table, the shroudlines carefully separated and drawn out taut toward right. Fouling of these lines would cause disaster.



2. Folding of the 'chute into a pack begins. Note that shrouds are still extended off toward right.

3. The 'chute is ready for packing, but first the shroud-lines are gathered, carefully arranged in place.

4. After the main parachute is placed in the pack, the small pilot 'chute is folded in on top of it.

5. The canvas pack is closed, and finishing touches are added with a flat wooden paddle. Packing job is now complete.

Goodbye to Blitz

by Major Malcolm Wheeler-Nicholson

War in the Panzers' graveyard—Russian tanks and infantry launch a counterattack against the stalled Nazis' defenses.

With the stopping of the Panzers, new weapons have come forward to carry the war into a new and different phase.

THE day of swift and overwhelming victory of the tank against infantry and machine guns is past. Infantry, equipped with adequate supporting weapons, has again found adequate defensive measures against new and powerful offensive weapons. It has reduced the tank, which threatened to oust it as the decisive arm in battle, to a secondary role.

Infantry has taken the Blitz out of Blitzkrieg, by increasing its defensive power. *But infantry has not increased its own offensive power.*

This will lead inevitably to a stalemate, another war of position like the last war, *if means are not found to overcome it.* The side that adds the most to the offensive power of the infantry most quickly, is the side that will win the war.

Infantry is the most ancient of the military branches. It has survived because it has always developed a technique for overcoming the surprise weapons and techniques arrayed against it. It has met and overcome forerunners of the tank before now, in its dogged, footslogging march down through the centuries. The *cataphracti* of Alexander's phalanx threw the chariots of Darius into panic just as the flexible and well-articulated maniples of the Roman legion stampeded the elephants of Pyrrhus. In much the same fashion, today the stolid and implacable Russian infantry has more or less stopped the German tanks from the Baltic to the Black Sea. The mass assault of the panzer divisions has been definitely slowed down.

The initial successes of the tank were in part due to the unpreparedness of its early victims and in part due to the tank's ability to combine within its own tactics two basic types of offensive. The one is the "break through" through the enemy's center with a spreading out and attack from the interior lines thus gained, on the enemy's right and left flanks. The other type of offensive is based on the concentric attack, i.e., encirclement.

The Germans actually combined these two types, and this strategy worked beautifully in France and the Low Countries because the enemy was improperly armed against frontal tank attack and possessed flanks vulnerable to

enemy tank encirclement movements.

Today the Russians are properly armed against frontal tank attack and, as in World War I, there now exists a more or less stabilized defense line with its flanks resting on, so far, impassable obstacles—a defensive line which the Red Army has converted into a springboard of attack.

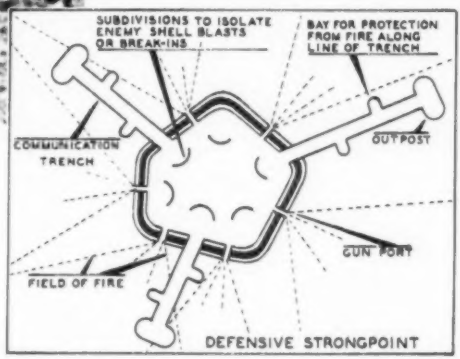
Because of the use by the Germans of the "hedgehog" defensive system developed by them in World War I, the Russian tank forces themselves were unable to exploit the retreat of the German army from Moscow in December, 1941. The Germans were able to fall back on prepared lines and hold practically all strategically important areas and strong points until they were ready to resume their offensive in the spring of 1942. But by that time the Russians had developed hedgehog defenses of their own.

It will clarify the present situation to glance at this "hedgehog" defensive system.

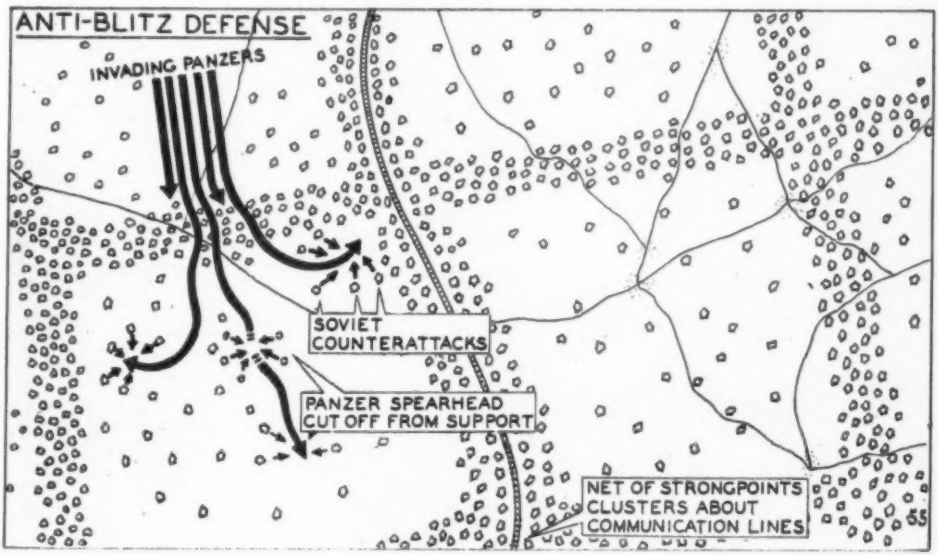
This system is proof of the truism that every offensive weapon, once the period of initial surprise has worn off, inevitably causes the appearance of effective defensive measures. The invention of chrome steel led to guns capable of firing greater explosive charges but led also to stronger armor plate.

The same thing has happened in the case of the tank. A little-known fact in regard to armored warfare is that almost immediately following its first effective use by the Allies in the latter part of World War I the Germans began developing the means for countering it.

Little attention was paid in the Allied armies to the German formation in 1917-18 of special so called "machine-gun sharpshooter squadrons" which were organized in tentative fashion by General von Ludendorff. Each of these squadrons consisted of three companies, and was composed of the elite of officers and soldiers. Unusual tactical freedom was allowed these units which were permitted to select their own positions and change them without permission from local higher authority. They also had supervision over the selection of their own personnel and could


SUBDIVISIONS TO ISOLATE ENEMY SHELL BLASTS OR BREAK-INS
BAY FOR PROTECTION FROM FIRE ALONG LINE OF TRENCH
COMMUNICATION TRENCH
OUT POST
GUN PORT
FIELD OF FIRE
DEFENSIVE STRONGPOINT

Left, a defensive strongpoint, unit of the hedgehog system of stopping tanks. *Below*, how the hedgehog system works: series of strongpoints are built in 25-mile squares, with scattered ones in the centres. Panzer divisions are allowed to knife through the camouflaged main line until well inside, are then, unable to get out again, cut to pieces by crossfire.



MARKSMANSHIP Scores Victories

Ever since the days of the Pioneers, American hunters and target shooters have trained themselves in marksmanship. That skill now *pays off* on battle fronts around the world.

For generations, Stevens has supplied accurate, dependable rifles and shotguns, essential to the making of proficient civilian shooters.

Right now, Stevens gun-making experience naturally is devoted to production of large quantities of military equipment. After Victory, there will be plenty of Stevens sporting arms—built to help *keep* America a nation of marksmen.

J. Stevens Arms Company
Div. of Savage Arms Corporation
Chicopee Falls, Mass.

STEVENS

Continued

Goodbye to Blitz

transfer men who proved unsatisfactory in battle. Under direct orders of the Army Command, these machine gun squadrons were sent to the areas of greatest pressure, being moved in trucks.

In the last few months of 1918 they were supplied with anti-tank and anti-aircraft guns in addition to their standard armament. Their training made them specialists in combatting tanks and in fighting against such rudimentary airplane bombing and strafing as occurred in the last war.

In 1918 these mobile squadrons covered the retreat of the German forces back to the Hindenburg Line and were responsible for heavy casualties to the advancing Allied forces. Their deadly fire power and extreme mobility, along with their high fighting qualities, enabled one of these squadrons consisting of only some 300 men and a couple of pieces of light artillery, to hold a village for several days against the massed and repeated attacks of several Allied divisions supported by tanks. Haig's attack in October, 1918, was stopped by them between Peolcappelle and Paaschendaele, and this without any supporting infantry or artillery. Time and again they were "sacrificed" on suicide tasks to hold off the advancing Allied forces, only to accomplish the missions and extricate themselves without serious loss. Their bravery and skill permitted the German Army commanders to reform their forces miles behind the isolated strong points formed by these squadrons.

It was here that the first use of the term "hedgehog defense" occurred. The revival in this war of the German tactic used so successfully in the latter stages of the last war was little noted by the public at large.

To strengthen these machine-gun sharpshooter squadrons against modern tanks, the Germans today use a number of infantry-accompanying high velocity anti-tank guns. They range from the light, single man, anti-tank rifle (taken incidentally from the Poles) to a 28 mm. infantry-accompanying gun. The anti-tank rifle has a muzzle velocity of 4,000 ft. per second, which permits its bullet to penetrate the one inch armor of light tanks and

An M-5, the U. S. Army's newest self-propelled tank destroyer. This full-track is fast, carries a potent wallop in its single 105 mm. cannon.

to knock off the eye ports of larger tanks. Next comes the light, compact, 20 mm. automatic cannon, which fires 200 shots a minute at either planes or tanks at 2,900 feet per second muzzle velocity. Probably the best infantry-accompanying cannon in any army today is the German Guerlich, whose 28 mm. shell (a little over one inch) partially jams in the tapered barrel and is reduced to 20 mm. The pressure of the explosive gases thus caused gives it a muzzle velocity of 4,750 feet per second, making it a deadly weapon against even heavily armored tanks (see MECHANIX ILLUSTRATED, December, 1942). Anti-tank cannon above these calibers more properly belong to the artillery, which the Germans have improved in like manner. The German 50 mm. anti-tank belongs in this category, as does the 88 mm. which in combination with the above guns knocked out 230 British tanks out of 300 at Knightsbridge in Egypt, June 13, 1942. This latter gun is highly mobile, its crew protected by armor and ready almost instantly to go into action. It has a muzzle velocity of 2,600 feet per second.

Detachments of troops armed with these weapons are based on heavily fortified "strong points," strategically situated, from which they can fight as from a series of fortresses, or issue out to make devastating counterattacks against advancing armored contingents.

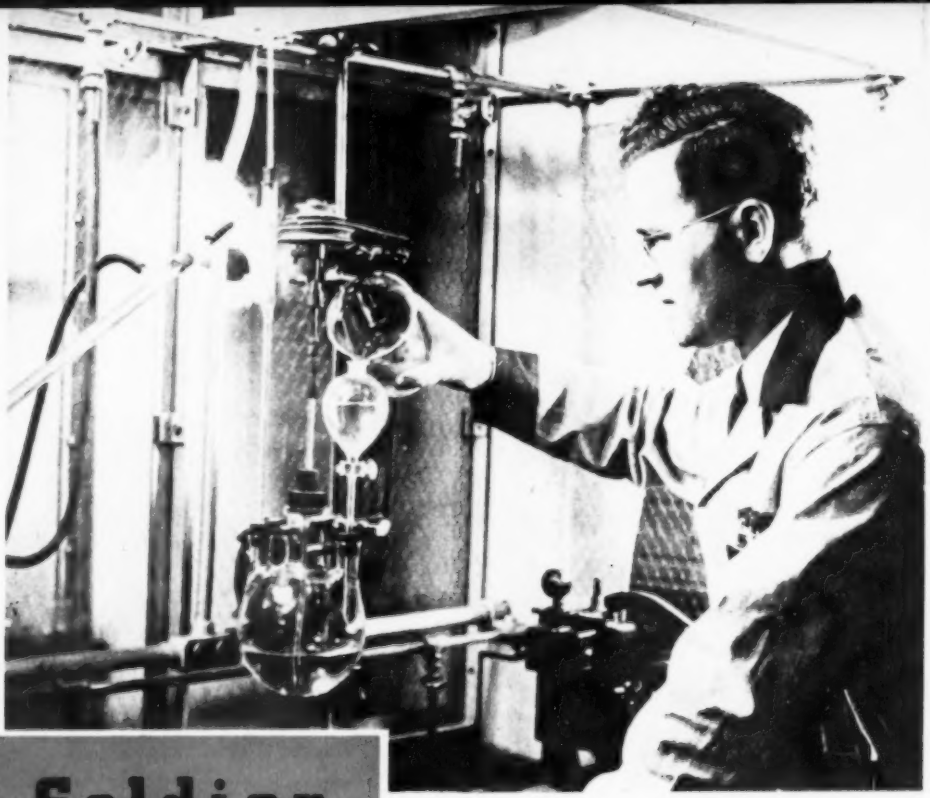
Thus it can be seen that both the Russian and German infantry has at last found a defense against the tank. Indications now point to a stalemate in land fighting, a return to the superiority of defense over attack that persisted until nearly the end of World War I.

In that war the defensive superiority was at last broken by tanks.

It was the mass of tanks, preceding his infantry, unloosed by Haig on August 8, 1918, that broke the German lines and courage. "It was the blackest day in the history of the Germany Army," said Ludendorff.

The tanks of 1918 were infantry-accompanying weapons, their speed gaited to the footslogging capabilities of the infantryman. When at last used properly, in front of instead of behind the attacking foot soldier, they were powerfully effective.

Between World [*Continued on page* 170]



Dr. Semon is pictured above in the laboratory at the Goodrich plant where all his pioneering research has been done.

Soldier of Science

Dr. Waldo Lonsbury Semon has been on America's battle lines for 15 years—advancing to victory!

by Darrell Huff and Lawrence N. Eldred

ON A morning in 1927 America won its first great battle in one of the major campaigns of this global war.

It was not won in North Africa, not in Europe, not in the lush islands of the South Pacific. It was won, in fact, in Akron, Ohio.

It was not fought by tanks, destroyers or planes. It was not won by an army. It was fought and won, without the firing of a shot, by one man—a 28-year-old chemist named Waldo Lonsbury Semon.

For on that morning more than 15 years ago young Semon burst from his laboratory at the Goodrich plant with a ball of yellow stuff in his hand, threw it to the floor, and as it rebounded, yelled: "Look! It bounces! It bounces!" That was his cry of victory; the yellow stuff was the world's first sample of Koroseal—the world's first practical substitute for natural rubber.

Koroseal right now is the waterproofing agent in raincoats that are keeping hundreds of thousands of our fighting men warm and dry. It's used, too, in the manufacture of stainless steel. And, after the war is won, it will help to give all of us better clothes.

Dr. Semon's tire-synthetic, Ameripol, *left*, looks like natural rubber, *right*, is processed exactly the same.

Dr. Semon's earlier synthetic, Koroseal, replaces rubber to make this attractive lightweight raincoat.

and tablecloths, and a hundred other things, than we've ever had before (see MECHANIX ILLUSTRATED, February, 1943). Even in 1927, when many of its most important modern applications were still hidden behind the veil of the future, Koroseal was recognized as a development of major significance. But for Dr. Semon, Koroseal was only a beginning, an opening skirmish of the great battle upon which he had embarked.

That battle had a double objective: to free the people of this country from the physical limitations of natural rubber, and also from the handicap of its geographical remoteness. In 1927, of course, the more important object appeared to be to overcome natural rubber's physical drawbacks—mainly, its susceptibility to attack by heat, age, oil and acids—and many chemists devoted themselves to accomplishing this by improving natural rubber itself. Fortunately—and only since the "day which will live in infamy" and the subsequent conquest by a vicious enemy of the world's sources of natural rubber, can we fully realize how fortunately—Dr. Semon attacked the problem's heart. He set out to find a synthetic substitute for rubber—a substitute that could be made from materials plentiful in our own land.

Another of Koroseal's many applications—a bright, colorful tablecloth that can be cleaned in a moment with a damp rag.

Koroseal, made of limestone, coke and salt, had been a great beginning, but only a beginning. For the great bulk of America's rubber consumption goes into one channel—automobile tires. And Koroseal, useful in many ways though it was, had one major fault: it was not suitable for tires. Dr. Semon went to work again.

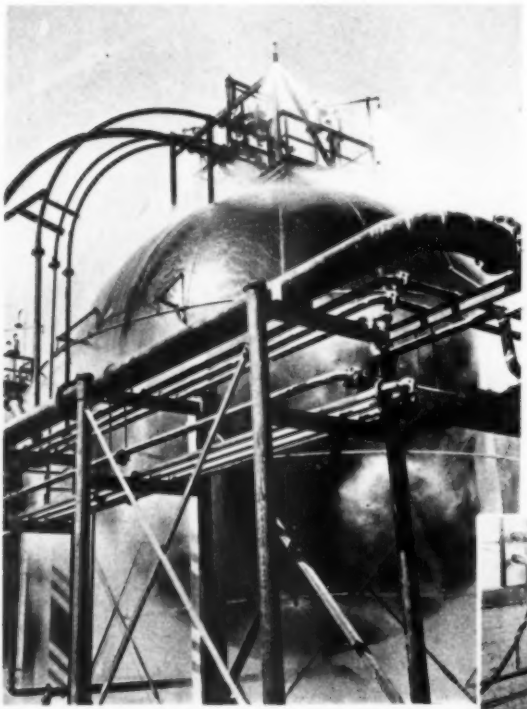
This time, however, he did not work alone. For now Dr. Semon was not just another young chemist, with the ink on his Ph. D. scarcely dry; he had proved himself able to do things with molecules that no man had ever done before. Dr. Semon moved for his new work into a larger laboratory at the Goodrich plant, and was given a corps of assistants—a general staff to fight a war that was fourteen years away.

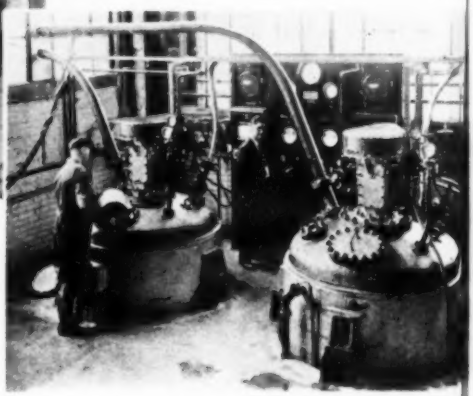
Even then, war was not new to Dr. Semon. During World War I he had interrupted his college career at the University of Washington to join the Army Intelligence service as a chemist. In his laboratory then he helped to defend his country by analyzing and exposing the secret inks used by hostile spies; he had helped to attack the enemy by developing a selenium analogue of mustard gas.

After the Big Show young Semon returned to college. But the atmosphere of war seemed to cling to him; on one occasion, in fact, it nearly brought to an untimely end not only his college days, but his college. For Waldo Semon had developed a great fascination for explosives, and spent hour after hour in the chemistry lab concocting new and different ones. And he was only too successful. One of his creations was so effective that when he and a friend tested it in a nearby lot, they all but blew down every building for blocks around. Only fast talking and faster thinking saved Semon & Co. from the wrath of the police, and enabled them to continue their studies with the tolerance, if not the enthusiasm, of the faculty.

Renouncing explosives after that debacle, he went on to graduate with honors in 1920, whereupon he promptly married a classmate, Marjorie Gunn, and began to work for his Doctorate of Philosophy in chemistry. Shortly after he had won it, came the offer of the job with Goodrich, in Akron. Young Dr. Semon, his wife and their small daughter set out at once from the West Coast for Ohio, in a jaloppy well supplied with second-hand spare tires.

It was well that it was so, too. For Dr. Semon, big, broad-shouldered, brown-haired and broke, had to make that stack of antique spares last through no fewer than 18 blowouts on the 16-day trip. By the time he arrived at Akron, he had not only improved his command of profanity to an astonishing degree, but the man who was to revolutionize America's rubber industry was ready cheerfully





Above, pressure-storage tank for butadiene, one of the bases of Ameripol. Water spray keeps tank surface cool, prevents fire.

Right, two big polymerizers and control panel. In these, butadiene and other ingredients of synthetic rubber are emulsified.

Soldier of Science

to murder anybody who so much as mentioned tires. This phobia died, luckily, during his work on Koroseal.

In his new laboratory after the development of Koroseal, Waldo Semon and his test-tube commandos plunged into intensive research. Koroseal had been born of a study by Semon of what other rubber chemists had done, in the course of which he had happened upon a report by a Russian, Ivan Ostromislensky, describing a tough, horny synthetic forbiddingly entitled "vinyl chloride polymer." This was hard, useless stuff, but it remained in Semon's mind. Koroseal was the eventual result of his efforts to plasticize and soften it.

Maybe some other, equally unpromising stuff held within itself the key to a still better substitute for natural rubber. Semon and his co-workers settled themselves to find out.

In the next fourteen years those tireless researchers developed nearly five thousand formulas. Working in secret they plunged into dead end after dead end. They found a myriad of formulas for making automobile tires, but in each there was some kind of flaw. The product was too expensive; or it deteriorated rapidly under light or heat; or it wasn't stretchy enough; or it wasn't tough enough; or . . .

But while every batch of tire-stuff failed, all was not discouragement. Many of the formulas they developed have found other uses; there is need of many kinds of synthetic rubber.

Not too proud to take a tip from nature, Semon tried one obvious angle of research. He went to natural rubber and studied its basic material, isoprene. And he found that isoprene is similar in structure to a man-made substance, butadiene—that same butadiene you've been reading so much about lately.

When petroleum is "cracked" in the manufacture of gasoline, butane gas is one of the by-products. If the refiner, instead of throwing it away, separates it and puts it under pressure, butane liquefies into this precious butadiene.

So Waldo Semon went to work with butadiene. He combined it with natural gas and air so that a rearrangement of molecules took place. Copolymerization, the process is called. Then Semon dumped it into a mixture of vegetable soaps.

He did this after months and years of hopeless failures and—almost as disheartening—near-successes.

He must have been as surprised as anyone when he tested the [*Continued on page* 173]

LIGHTER MOMENTS

with fresh

Eveready Batteries

"Loan me your flashlight willya? The Major's got a little something in his eye"

FRESH BATTERIES LAST LONGER . . . Look for the date line ⟶

REMEMBER—our fighting forces need "Eveready" flashlights and batteries and the materials they are made from. You can serve by conserving yours!

EVEREADY

The word "Eveready" is a registered trade-mark of National Carbon Company, Inc.

"A Miracle Saved Me"

The Complete Story of His Rescue as Told by

Captain Eddie Rickenbacker

Capt. Rickenbacker is helped from the plane which flew him out of the shadow of death.

WE ARRIVED in Hawaii by clipper. We left that evening. We were going to leave for our first destination, which was in the South Pacific, at 10:30 A. M. As we were taking off, the hydraulic system let go on the left-hand brake and it looked as if we were going to take down all the hangars at Hickam Field. They had to ground loop into the runway.

I was informed there was another ship available and that by switching the equipment, baggage and mail, we would be ready to go, and were, about 1:30 A. M. It was a beautiful night. I went to bed in the tail end of the B-17 on a cot.

I awakened in the morning about 6:30 and went into the cockpit. Everything was serene. The ship was purring along beautifully and we were due to land at this island at 9:30. At 10:30 we hadn't seen it. In the meantime I was a little bit worried; the navigator was worried and so was the pilot.

I asked them if they had called for bearings and that was when we found we had difficulty with our radio system. Not only that. After double checking our compass we found the compass had not been swung and that the outfit was off several degrees, which complicated our problem.

I felt and said at the time that I thought we had overshot, because I felt we had more of a tail wind than the boys thought they had. Mind you, there were no weather stations like we have in this country, no teletype to get the weather around; it is all based on long-range forecast and isn't always as accurate as it might be. I definitely feel that condition will be eliminated and improved upon in the very near future.

I jumped ahead of my story when I

The rafts on which Capt. Rickenbacker and his party lived and drifted in the South Pacific. The small raft carried Capt. William Cherry; the larger one was the only home of Capt. Rickenbacker and two other men for more than three weeks.

mentioned we had overshot. The forecast showed a ten-mile tail wind, and later as I was going into Australia, it so happened the navigator of the crew that was sent out from the States to pick us up in the Samoans happened to have gone out that very night on General Lewis' plane one hour before we went out.

Talking about getting lost, he said they might have been lost if it had not been for a certain amount of chance. He said he went in there that morning and proved it to be a tail wind of about thirty knots instead of ten miles per hour, which verified my original suspicion that we had overshot. When we called for bearings the radio problem showed up, and we didn't get—couldn't get—them.

One of the stations tried to give us what they could and gave us a certain course to follow, but we couldn't get the cross bearing on it, so it didn't make much difference. It wasn't worth a great deal.

We kept flying and finally decided to try the old box method of locating something, looking for a ship, an island, and under those conditions you get out there what they call island-eyes—you see land from different angles and it is nothing more than cloud shadows.

But when you want to find land and are anxious to see it you multiply it ten-fold. We had that problem but time was fleeting and our gas supply was running low. We didn't know where we were and we knew that no one else knew. There wasn't anything we could do about it but keep going, hoping we would run into something. It finally got down to where we shut off two outside engines to save our gas and cruised along on the two inside ones and our last message out was that we had an hour's gas left, approximately.

We then started to pound out the S. O. S. Our radio operator did that for one solid hour. In the meantime we dropped everything in the way of mail, tools, and baggage

Above, Col. Hans C. Adamson, whose back was injured in the forced landing at sea, is carried to a base hospital after 22 days afloat.

and equipment that was loose in the ship, and if you ever think that material things are worth anything, ladies and gentlemen, have that experience and you will find out how useless they are no matter how you may have cherished them.

We put our water and rations in the radio compartment; the mattresses we put up against the wall to cushion the shock, and through expert piloting on the part of Captain William T. Cherry, plus a lot of good luck, we went into a trough and landed up against the big swell. We might have been so unfortunate as to have hit the top of the swell and we would have gone on down.

Colonel Hans C. Adamson got a sprained back out of it; the radio operator got a badly bumped nose. There were five of us in the radio compartment and when we hit we didn't skid very far, as you can appreciate. It was rather sudden and none too comfortable a shock and a portion of our radio, which was on the wall in the tail end, let go and came up and broke down the door into the compartment and that upset things, with Colonel Adamson's sprained back and the fact that when the boat on my side was kicked out the raft got tangled in the ropes.

I can say frankly that all of us were so anxious to get away from the ship before she sank we didn't pay much attention to our rations. We had no water when we went off and we had no food. We saved four oranges, and they were scrawny ones at that, which we lived on for eight days. I carved up those oranges into eight pieces and rationed them out, and if you ever had seven hungry pairs of eyes watching you carve, you prove to be a pretty good carver, even though you haven't got the facilities—the parts were pretty well balanced.

Unfortunately, the little boat, the two-man boat, upset, and this boy we lost went overboard. He swallowed some salt water and was violently seasick for several hours, which didn't contribute to reducing his thirst any; it multiplied it.

Staff Sergeant Alexander Kaczmarczyk, who died of exposure and was buried at sea, not long ago sent this picture of himself to his sister "With love."

Several of us were feeling none too good because it was rough. The boy got to drinking salt water during the night, unbeknown to us, and between salt-water poisoning and starvation, we lost him on the night of the 13th.

I had taken a piece of rope out of the ship and we tied the boats together about twenty feet apart. We put Captain Cherry and the

Continued
"A Miracle Saved Me"

co-pilot, Second Lieutenant James C. Whitaker and the radio operator in the front one, Colonel Adamson and the little engineer, Private John F. Bartek and myself in the middle, and the navigator and crew chief, Sergeant Kaczmarczyk, in the other.

After we got going naturally we got to thinking about our food and water, but we didn't dare go back to the ship for fear she would sink and suck us down with it. Then we ran into a five-day calm, which left the ocean like a mirror. It was beastly hot.

Most of the boys had thrown off their shoes and some, their socks, and that was unfortunate. They felt they might have to swim, but it turned out they had their feet and legs burned very badly. Two or three of them had nothing but a jumper on, no hats.

I was more fortunate. I had a pair of high-top shoes on on account of my bum foot and an old felt hat that Mrs. Rickenbacker had been trying to get me to get rid of for the last ten years. It proved to be very valuable. I filled it with salt water and put it down before my eyes.

I had grabbed three or four handkerchiefs and we passed those around and put around our nose and face, bandit fashion, which helped, but it was very hard on our hands and face, and feet, particularly.

We had no rain until the eighth night. We saw nothing in the way of searching planes or ships. The little boy in my boat had an issue Bible in the pocket of his jumper, and the second day out we organized little prayer meetings in the evening and morning and took turns about reading passages from the Bible, and frankly and humbly we prayed for our deliverance. After the oranges were gone there showed up a terrific lot of pangs of hunger, and we prayed for food.

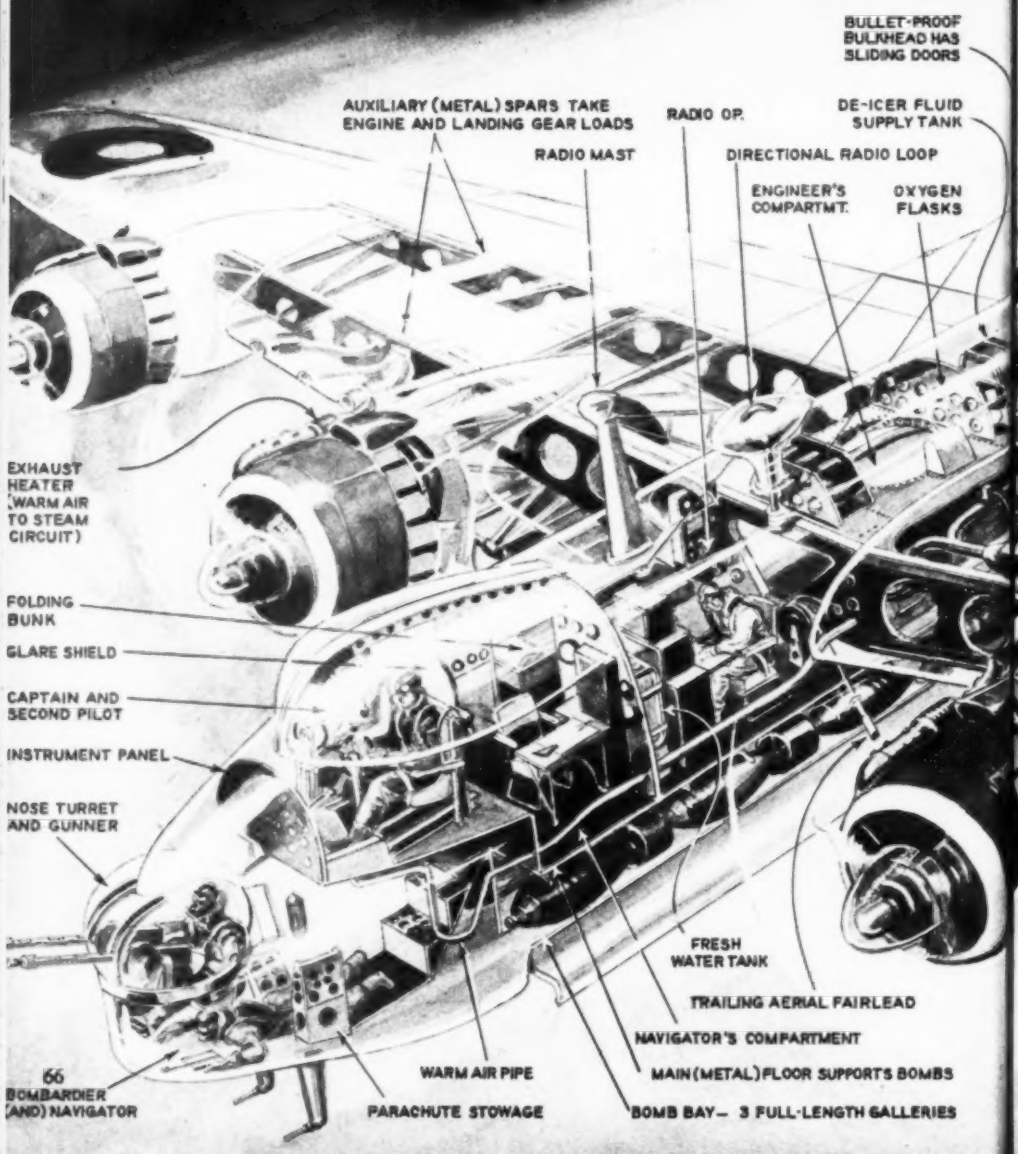
We had a couple of little fish lines with hooks about the size of the end of my little finger, but no bait, and if it wasn't for the fact that I had seven witnesses, I wouldn't dare tell this story because it seems so fantastic. [*Continued on page* 165]

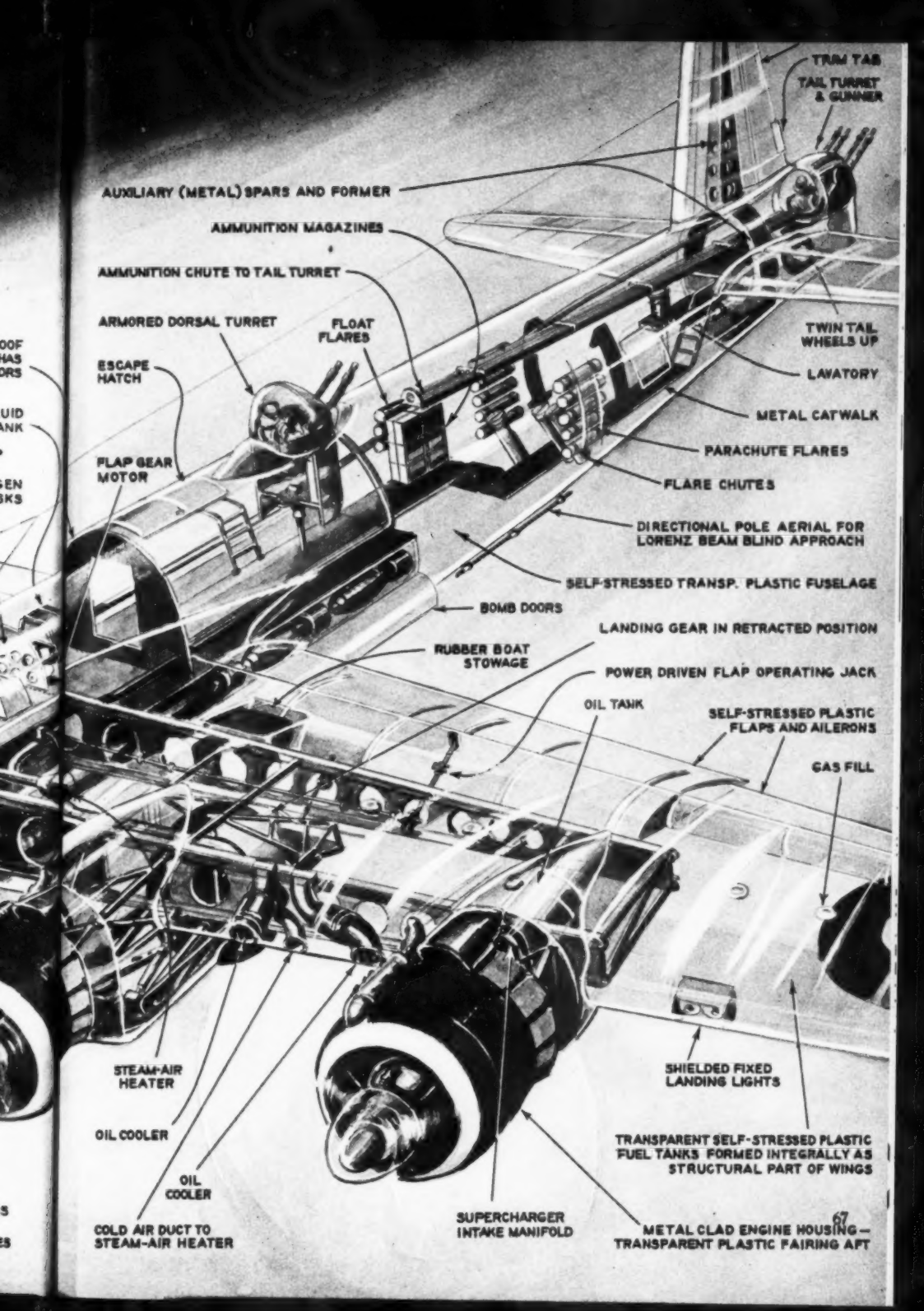
Lieut. John de Angelis (back to camera) and, *left to right*, Lieut. James Whitaker and Captain Cherry and Rickenbacker, enjoy their first real meal in more than three weeks. Fifth man (unidentified) looks on.

Transparent Bomber

by Lieutenant Douglas Rolfe, R.A.F. (Hon.)

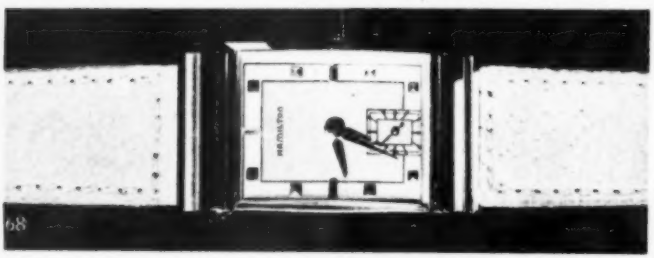
HERE'S an idea for an all-plastic bomber, which would be practically invisible at bombing altitudes. It's based on a British Sterling. The design enables you to see exactly how a big bomber operates.




TRIM TAB
TAIL TURRET & GUNNER
AUXILIARY (METAL) SPARS AND FORMER
AMMUNITION MAGAZINES
AMMUNITION CHUTE TO TAIL TURRET
ARMORED DORSAL TURRET
FLOAT FLARES
ESCAPE HATCH
FLAP GEAR MOTOR
TWIN TAIL WHEELS UP
LAVATORY
METAL CATWALK
PARACHUTE FLARES
FLARE CHUTES
DIRECTIONAL POLE AERIAL FOR LORENZ BEAM BLIND APPROACH
SELF-STRESSED TRANSP. PLASTIC FUSELAGE
BOMB DOORS
LANDING GEAR IN RETRACTED POSITION
RUBBER BOAT STOWAGE
POWER DRIVEN FLAP OPERATING JACK
OIL TANK
SELF-STRESSED PLASTIC FLAPS AND AILERONS
GAS FILL
STEAM-AIR HEATER
OIL COOLER
OIL COOLER
COLD AIR DUCT TO STEAM-AIR HEATER
SUPERCHARGER INTAKE MANIFOLD
SHIELDED FIXED LANDING LIGHTS
TRANSPARENT SELF-STRESSED PLASTIC FUEL TANKS FORMED INTEGRALLY AS STRUCTURAL PART OF WINGS
METAL CLAD ENGINE HOUSING — TRANSPARENT PLASTIC FAIRING AFT

WANT AN AERONCA
GET IN THE BIG

1st PRIZE The sweetest thing in the air, among light planes, is the Aeronca Defender Training plane, built by the great Aeronca Aircraft Corporation. First prize in this contest is YOUR CHOICE of such an airplane—if one is available for delivery—or $1,500.00 in War Bonds at maturity value! Win it!



2nd PRIZE

The Hamilton Watch Company makes "The Watch of Railroad Accuracy." Here is one of their most beautiful models, a 19-jewel strap watch which retails for $165.00!

AIRPLANE FREE?
"BUILDWORDS" GAME!

BETTER get in the game right now!

Here's your chance to win a brand new Aeronca Defender Trainer—or $1,500 in War Bonds—absolutely free! And there are scores of other great prizes, too! Just look over the pictures of them on these and the next six pages!

And the best part of it is that you can have the time of your life doing it. Just play the new MECHANIX ILLUSTRATED "BUILDWORDS" game. You'll find it a real thrill!

IF YOU DIDN'T START THE GAME LAST MONTH, YOU CAN START NOW. WE ARE REPRINTING LAST MONTH'S "BUILDWORDS" PUZZLE ON PAGE 183.

"Buildwords" is easy as falling off a log—and more fun than a picnic. Look over the prizes on the following pages, then turn to page 76 for full instructions on how to enter this great contest.

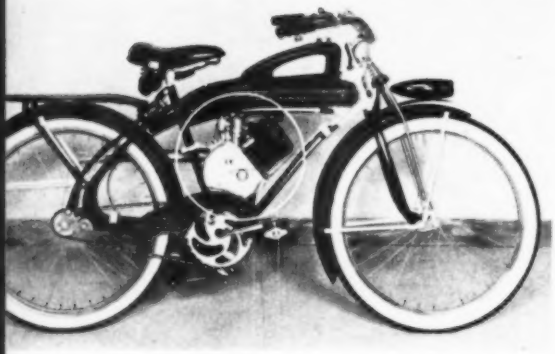
First prize is YOUR CHOICE OF: 1. An Aeronca Defender Training plane (if, due to war conditions, one is available for delivery when this contest is concluded); OR, 2 $1,500 in War Bonds, maturity value!

3rd PRIZE

A Sky Champion four-band radio receiver, made by the famous Hallicrafters Co. The Hallicrafters Co., says of it: "We believe that, without exception, the new Sky Champion represents the best value ever offered in the communications field!"

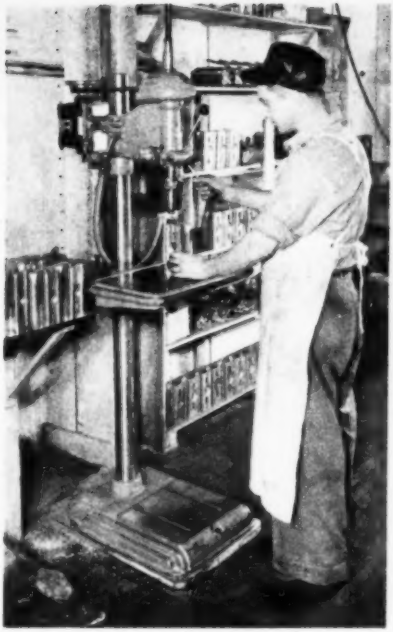
TURN THE PAGES FOR MORE GREAT PRIZES

Free Prizes!



4th PRIZE

WHIZZER $59.95 Bicycle Motor! Weighs 28 lbs., fits any bike! Makes a motorcycle of your bicycle! Does not interfere with pedalling! Quiet, dependable. 120 miles to gallon of gas, 25 to 30 m.p.h.! All you defense workers should be interested in this fine prize!



5th PRIZE

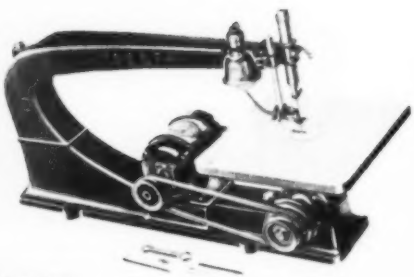
ATLAS Drill Press worth $56.50! Rugged floor-type mounting, 40½" capacity over table and 46" capacity over base. Equipped with various accessories, the Atlas Drill Press becomes a versatile combination machine for such operations as shaping, mortising, routing, carving and sanding.

6th PRIZE

$50 ZEPHYRPLANE JR. Belt Sander! Lightweight, Skilsaw product! Produces a ripple-free finish in a jiffy! A Zephyrplane is indispensable in woodworking and cabinet work! Here's your chance to win one of these grand workshop tools!

7th PRIZE

$42.50 Keystone Movie Camera! Equipped with f3.5 lens! Three speed! 16-Millimeter!

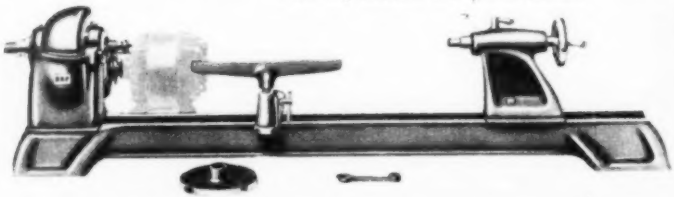


8th PRIZE

DELTA 24", 4-speed scroll saw! 4 blades, 4-speed cone pulley on arbor! Timken crankshaft! Shaft-driven blower pump! Valued at $36.50!

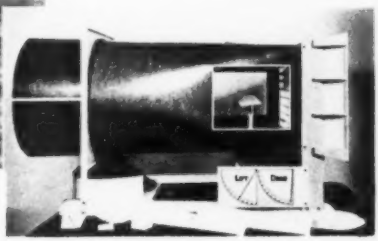
9th PRIZE

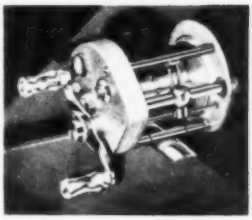
$33.50 POWER KING Woodworking Lathe! Equipped with SKF Ball Bearings! Strong, rigid foundation! Carefully machined for long service! Excellent for light metal turning, machining alabaster and various plastics!



10th PRIZE

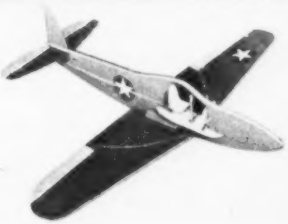
WINNER Water Skis! Waterproof! Rubber foot harness! Valued at $30.00.





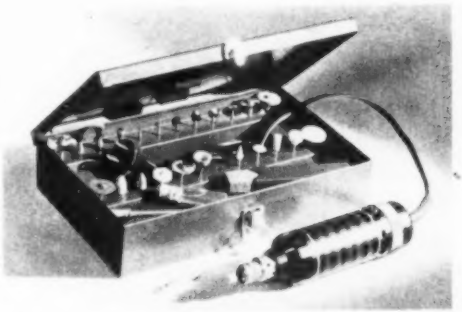
11th PRIZE

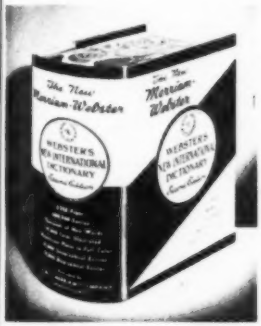
COMET Wind Tunnel! Has many features of full scale experimental tunnel! Includes a honeycomb to straighten out airflow and contains windows so that action can be viewed from outside. It is 24" high, 27" wide, and 45" long. A real find for model fans! COMET Extra! Air-O-Trainer Model with actual cockpit controls that move ailerons, rudder and elevators exactly as on real airplane! Can be assembled in short time! All parts are finished! Combined value $26.50!



12th PRIZE

$25 PLUEGER "Supreme" Fishing Reel! A prize for any fisherman! Lightweight, distinctive in design!





13th PRIZE

Ultra Deluxe "HANDEE" Workshop Tool valued at $25! 27 fine accessories! Excellent for grinding, drilling, polishing, cutting, carving, sanding or engraving.

15th PRIZE

Webster's New International Dictionary, 2nd Edition, worth $22.50! Here's a prize you can't afford to miss! Buff buckram binding, marbled edges, indexed! Stands the test of service!

14th PRIZE

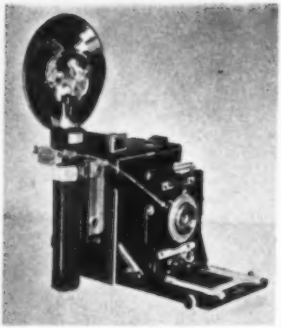
Flexible Flyer $24.50 SPLITKEIN SKIS! Made by S. L. Allen Co., Phila. Designed in Norway by ski-making experts. Skiing is America's newest sport. Get into it now, with this swell prize.

16th PRIZE

Fine BAUSCH & LOMB $22.50 Microscope! Especially designed for the amateur! Magnifications from 75 to 300 diameters. Complete with instruction book, blank slides and equipment!

DETAILS ON PAGE 76

More Prizes!

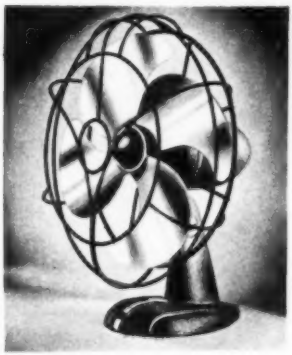


17th PRIZE

KALART $20 automatic Speed Flash! Mechanical, self-cocking, universal synchronizer! No winding! No cable!

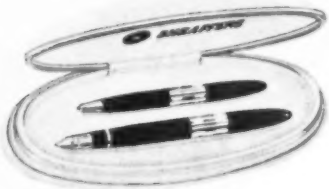
18th PRIZE

SAMSONITE TWO SUITER! Men's two-suit traveling bag! Strong! Roomy! Accommodates complete wardrobe! Ideal for the man who travels! Value—about $20.



19th PRIZE

$19 F. A. SMITH ARCTIC-AIRE fan! This streamline, dust-proof, modern 12" four-blade electric fan will keep you comfortable in the hottest weather!



20th PRIZE

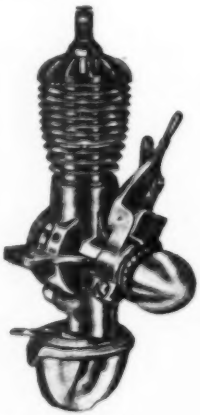
SCHEAFFER'S "Triumph" Tuckaway Ensemble! Clipless, designed to carry safely in any position! Diminutive when closed, full size when open! Perfect for a lady's purse, man's trouser pocket, or Service man's uniform. Value—$16.50.

21st PRIZE

IVER JOHNSON 16 Gauge Matted Top Rib Single Barrel Shotgun! The stock has Full Pistol Grip and trap style forend of fancy design, both black walnut! Value—$16.50.

22nd PRIZE

SPALDING Krobat Tennis Racket! Sturdy 10 ply laminated frame of ash and fibre! Fibre-welded throat! Adds strength with weight-power without loss of touch. High quality stringing.

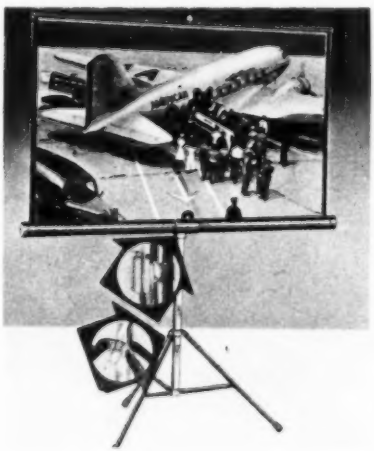


23rd PRIZE

MIGHTY ATOM model gas engine! Sleek, streamlined powerplant for model planes, cars, boats! Precision in design and construction, and 1¾-ounce weight make it top notch! Value—$15.50.

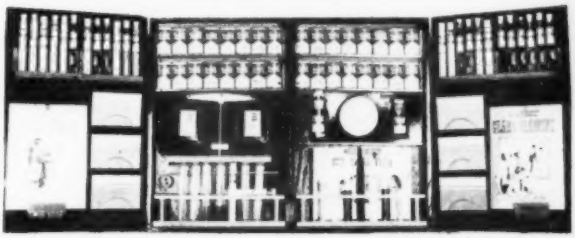
24th PRIZE

RADIANT Hy-Flect movie screen! Glass-beaded screen surface gives unsurpassed brilliance, clarity and detail to your movies! Climate-proof! Won't crack! Value—$13.75.



25th PRIZE

GRAPHOMAT Multi-Lens photo enlarger! Ideal for the photo enthusiast! An item of equipment that anyone who owns a camera can use to advantage! Value—$11.85.

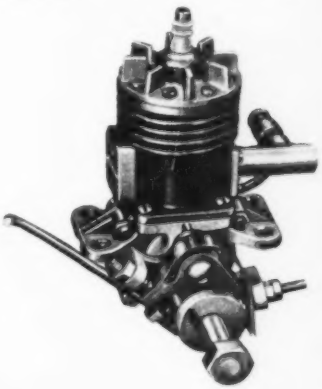


26th PRIZE

GILBERT No. 10 Inventor's Chemistry Laboratory! One hundred items of chemicals and apparatus! Seven and one half feet of test tube racks and shelf room! Scales, and three big books describing more than six hundred experiments in chemistry, glass blowing, and chemical magic! Precision made, so that experiments can be performed under rigid control! Ideal for the person who wants to learn chemistry! Value—$10.95.

27th PRIZE

LEKTROLITE Safety Lighter and Ash Tray! A handsome and useful adornment for the home. Beautifully finished and safe! Lights your smoke without a flame! Value—10.00.

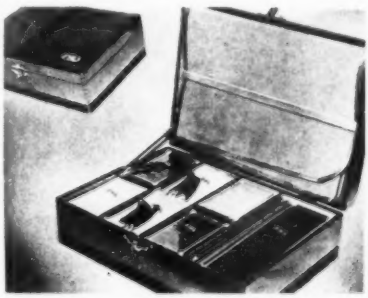


29th PRIZE

WESBAR Car Top Utility Carrier! Enables you to carry boats, ladders, lumber, etc., on top of your car without marring finish! Fits cars with metal or fabric center tops! Instructions for installing included! Value—$8.50.

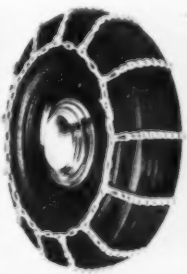
28th PRIZE

$9.95 G.H.Q. Gas Model Motor! Ready to run! Model builders will get a thrill from this modern powerplant! Can be used in model planes, cars, or boats! Carefully designed and built for today's models!



30th PRIZE

MILES KIMBALL Deluxe Bridge Chest! This handsome chest of hand rubbed walnut will include initials of winner, in large, gold finished metal letters! Contains four decks of cards, suede table cover, and many other items for bridge! Value—$7.95.



31st PRIZE

$7.75 WEED Tire Chains! Non-Kinking! Electric welded! They'll add many miles to tire life by preventing needless wear from skidding!

DETAILS ON PAGE 76

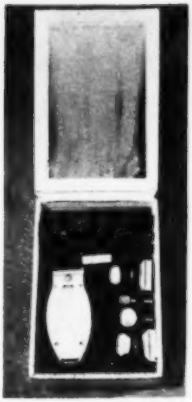
More Prizes!

32nd PRIZE

RONSON Table Lighter! Valued $7.50 Superb craftsmanship in this compact but copious silver plated table lighter! Exquisitely wrought design in antiqued relief reflects the Modern-Danish influence. Padded base.

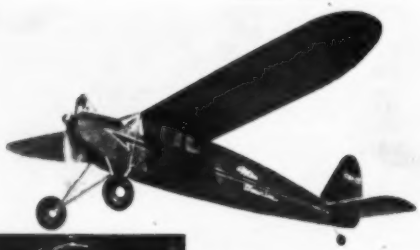
33rd PRIZE

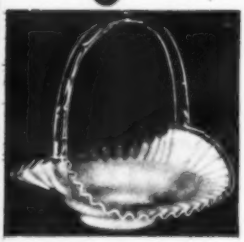
PACKARD Electric Shaver worth $7.50! Complete with accessories! May be used with either AC or DC current! Here's your opportunity to get that electric shaver you've been wanting for so long!



34th PRIZE

SCIENTIFIC Construction Kit for the "Miss America"! One of the nation's favorites! In design, accuracy and completeness, it represents everything a gas model should be! Complete assembly kit and clear, full-size plans!





35th PRIZE

FENTON Handled Basket in Peach Crest, product of one of the country's foremost manufacturers of fine glassware! Entirely hand made of cased glass.

36th PRIZE

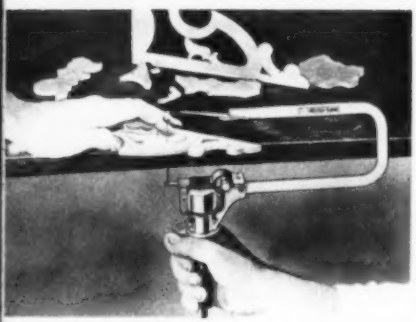
DAISY Defender 1,000-Shot Military Model Air Rifle! Also, Daisy Bell Target and 5 tubes of Daisy Bull's-Eye Shot! Production has stopped on this particular rifle, so don't throw away this chance to get one of the few left! You'll be proud to own this 1,000-shot, army-style air rifle. Valued at about $5.75!

37th PRIZE

NEW DEPARTURE Conversion Unit worth $5.25! Easily attached! Low gear for faster getaway and easier riding on hills! Made of best chromium, nickel-chromium and manganese steels for strength and long life!

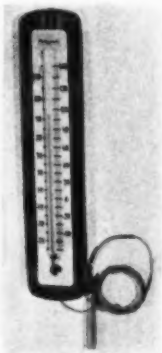
38th PRIZE

BOYCE-MEIER Sextant! Retails at $4.95. Almost an indispensable part of a marine navigator's equipment. No guessing or looking for landmarks. Find your favorite fishing grounds or anchorage at once!



39th PRIZE

$4.85 DREMEL Moto Saw! Weighs 17 oz., consumes only as much current as a 75-watt bulb! Cuts at an average of 1 ft. per minute through wood ¾" thick; high speed eliminates sanding!

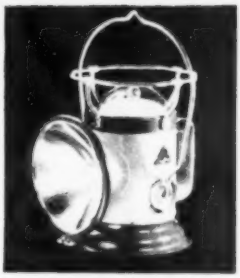


40th PRIZE

FEE & STEMWEDEL Remote Reading Thermometer. Though mounted indoors, accurately registers *outdoor* temperature! Rich in appearance and easily read! Valued at $4.50!

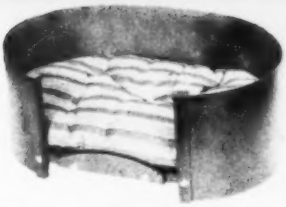
41st PRIZE

12 Tubes of LIFEBUOY Shaving Cream! Don't let this prize get away from you! 120 to 150 shaves in each tube! Gives a smooth, easy shave! And you don't need an old shaving tube—just enter our contest and have a try at corralling this prize for yourself!



42nd PRIZE

DELTA POWERlite, worth about $4.00 Economical safe, no inflammable liquid. No wires to cross. Gives 40 hours constant use from one 6-volt dry cell. 1,200 beam candlepower light!

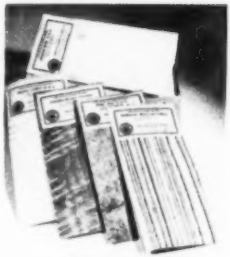


43rd PRIZE

G-H SPECIALTY Bent Wood Dog Bed. Designed, styled, and finished in keeping with modern home furnishings. Sturdy, practical! Valued at $3.95!

44th PRIZE

New Electric Arc Welder! Uses standard coated welding rods, AC or DC. Plugs into 110-volt socket. Handy, light, easily portable. Sturdily constructed, fine quality materials. No skill or experience is needed—anyone can operate this arc welder!

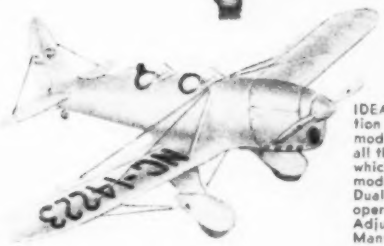


45th PRIZE

CONSTANTINE Set of Rare Wood Samples, worth $2.75! Large enough to allow detailed study for texture and character. If you wish to see the different woods of the world, then don't miss this opportunity!

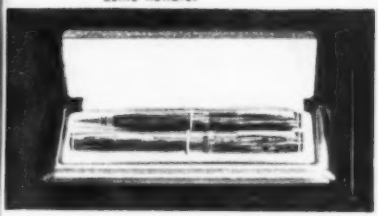
46th PRIZE

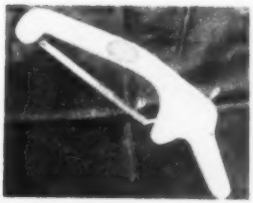
NORTH BROS. "Yankee-Handyman" Spiral Screw Driver! Retails at $2.39! To drive or draw screws, just push! Quick return spring! Transparent magazine handle.



47th PRIZE

IDEAL Ryan S T construction kit! This graceful model, valued at $2.00, has all the super-detail features which mark it as a flying model of the finest quality! Dual control system which operates in either cockpit! Adjustable wing flaps! Many other fine features!



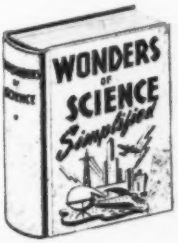


48th PRIZE

EPCO Safety Saw for Live Work! Frame of insulating material! Made of hard wood and treated to prevent the absorbtion of moisture or oil! Value about $2.00!

49th PRIZE

EBERHARD FABER Permapoint Pen and Pencil Set! Deluxe Gift Box! Pen is iridescent pearl, with chromium trim. Pencil has propel-repel-expel action, extra thin leads! Retails for $1.50.



51st TO 70th PRIZES

METRO PUBLICATIONS "WONDERS OF SCIENCE SIMPLIFIED"! A trip into the world of science through the pages of this fascinating book! Three thrilling volumes in one! Packed with dozens of pictures! Simple and easily understood text! Twenty lucky readers will be thrilled with this book which retails for $2.00 a copy!

50th PRIZE

CASCAMITE 1-lb. can of Powdered Resin Glue and CASCO 1-lb. can of Powdered Casein Glue, valued at about $1.50! Home workshoppers, here's a prize you'll be glad to have!

71st TO 95th PRIZES

KNICKERBOCKER'S "FUN FOR BOYS"! An exciting group of tricks, games and novelties to delight young and old alike! Don't overlook this opportunity to obtain a copy of this marvelous work. Twenty-five lucky contestants will be delighted with "Fun For Boys" which sells for $1.00 a copy.

HERE IS PUZZLE NO. 2 IN

CONTEST RULES

1. A different "BUILDWORDS" puzzle will appear in each of the February, March and April issues of MECHANIX ILLUSTRATED. The second puzzle appears on the opposite page. Puzzle No. 1 is reprinted on page 183. Contestants will complete each of the three puzzles, striving to attain the highest score possible and printing the score in the proper place marked "my high score is" on each of the entry blanks, together with the name and address of the contestant. The third entry blank will contain a space marked "GRAND TOTAL" in which the contestant will print the total accumulated in all three puzzles.

2. The individual having the largest correct grand total as printed in the third entry blank will win first prize. The individual having the second largest grand total will win second prize, etc. In the event of a tie for any prize, the individual turning in the neatest, most original and most legible entry will be awarded the higher prize, with the next prize going to the tying entry. However, "fancy" entries will in no case be given preference.

3. Do not send in entry blanks separately. Save your February and March puzzles until you have completed your April puzzle and send in all three blanks together by first class mail, addressing them to "BUILDWORDS EDITOR," MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y.

4. Contestants may submit legible copies of the first two entry blanks as their official entry if they so desire. The third entry blank must be the one clipped from the April, 1943, issue of MECHANIX ILLUSTRATED. (Note: This is permitted because the contestant may secure a larger score after practice.)

5. Webster's New International Dictionary, Second Edition, will be considered final authority on acceptance of words used in the puzzles. Words appearing anywhere in this dictionary will be acceptable. However, hyphenated words and possessives formed with an apostrophe are not acceptable. Proper nouns and regular plurals, under dictionary definitions, as well as irregular plurals found in the dictionary, are acceptable.

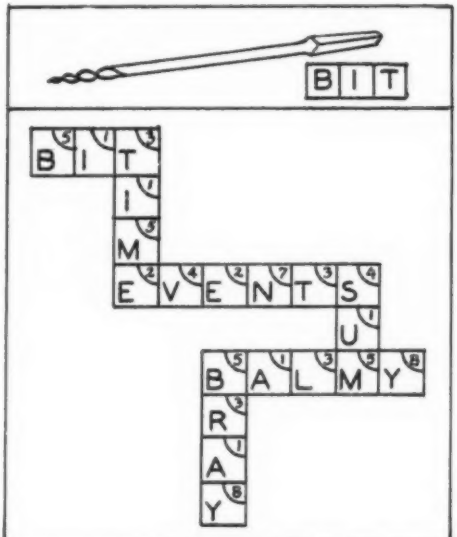
6. No entries will be returned and under no circumstances can we enter into correspondence regarding this contest. Judges will be the Editors of MECHANIX ILLUSTRATED. Their decisions will be final. Anyone in the United States or Canada may compete except employees of Fawcett Publications or members of their families.

7. No contestant may win more than one prize. Neatness, originality and legibility will be considered in judging all entries.

8. This contest closes April 1, 1943. Entries postmarked in the mail later than midnight on that date will not be considered.

9. First prize will be an Aeronca Aircraft Corporation airplane of the trainer class. If war conditions make delivery of such airplane impossible, the winner of first prize agrees, as a condition of this contest, to accept, instead, $1,500.00, maturity value, in War Bonds. It is understood that in the event any of the manufacturers of any of the other prizes offered in this contest are unable to make delivery of such prizes, due to war conditions, at the conclusion of this contest, the prizewinner will accept in lieu of the actual prize a "Victory Certificate" redeemable for such prize at such time as that manufacturer resumes normal production.

SPECIMEN PUZZLE



LETTER VALUE CHART

A — 1	G — 2	M — 5	T — 3
B — 5	H — 5	N — 7	U — 1
C — 2	I — 1	O — 2	V — 4
D — 4	J — 5	P — 1	W — 3
E — 2	K — 6	Q — 2	X — 5
F — 4	L — 3	R — 3	Y — 8
		S — 4	Z — 6

MY HIGH SCORE IS 72

THE MI PRIZE CONTEST!

HOW TO DO "BUILDWORDS"

"BUILDWORDS" is as easy as rolling off a log. Just look at the specimen "BUILDWORDS" on the opposite page. It has been filled out for your guidance.

FIRST: You will notice that the first thing we did on the specimen puzzle was to identify the tool shown in the picture at the top. It's a BIT, of course. Then we write in its name in the space provided for this purpose just below the picture.

SECOND: We found a three-letter space among the squares below. You will note we put the word in the top three squares. We might just as well have put it in the other three-letter square group where you now find the word SUM. This month's word is a five-letter word.

THIRD: Fill in the other rows of interlocking squares, using the "T" in BIT as a jumping off place. Use only accepted dictionary words, as explained in the rules. Each letter has a different numerical value, given in the chart below the specimen puzzle. The letter "Y" has the highest value, as you will note, so you obviously should try to get in as many words with "Y" in them as possible, to bring up your score.

(Note: The numerical values of letters change from month to month in these puzzles. Last month, the letter "L" had the highest value, as you will see by referring to last month's puzzle, reprinted on page 183.) Place the numerical value of each letter in the corner of the square. All words must read from top to bottom or from left to right.

FOURTH: After you have fitted words into all of the interlocking squares, as demonstrated in the specimen, add together the values of all the letters and print your total score in the space provided for it at the bottom.

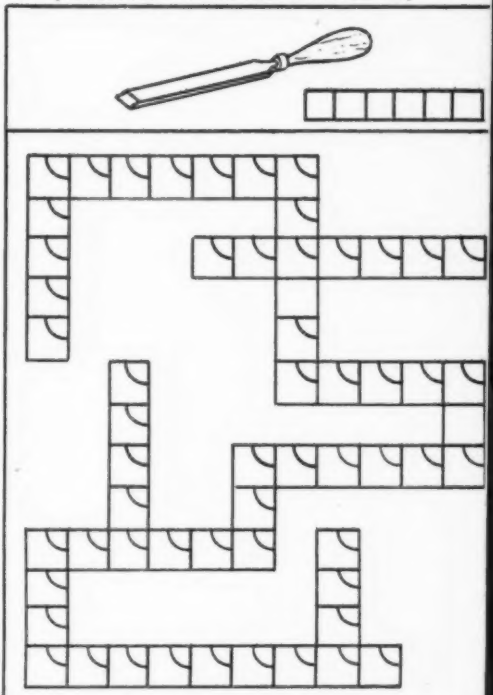
FINALLY: READ THE RULES CAREFULLY AND FOLLOW THEM PRECISELY!

CONTESTANTS!

Would you like to have a chance to win a cash prize, as well as one of the regular contest prizes, shown on the preceding pages? If you would, turn to page 181 and see how you can win a Cash Sponsorship prize, merely by telling your friends about MECHANIX ILLUSTRATED'S great "Buildwords" contest!

PUZZLE NO. 2

(PUZZLE NO. 1 REPRINTED ON PAGE 183)



LETTER VALUE CHART

A — 1	G — 2	M — 5	T —
B — 5	H — 5	N — 7	U —
C — 2	I — 1	O — 2	V —
D — 4	J — 5	P — 1	W —
E — 2	K — 6	Q — 2	X —
F — 4	L — 3	R — 3	Y —
		S — 4	Z —

MY HIGH SCORE IS

NAME .....

ADDRESS .....

CITY..... STATE.....

If you were sponsored in this contest fill out the following. If not, leave these spaces blank.

SPONSOR'S NAME.....

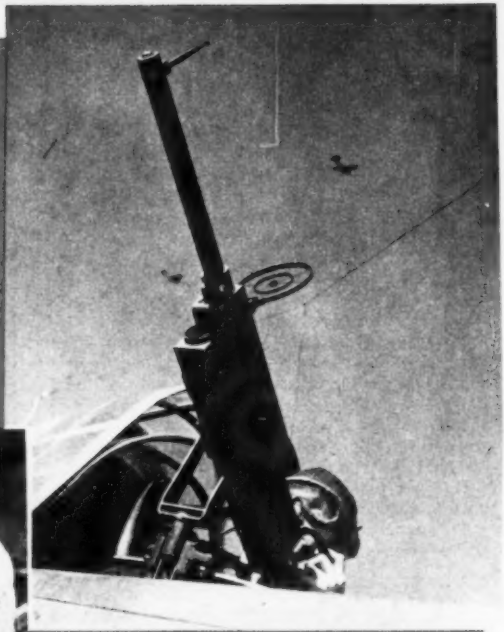
ADDRESS .....

CITY..... STATE.....

Save Puzzles No. 1 & 2 until you have completed Puzzle No. 3 appearing in the April issue of MECHANIX ILLUSTRATED. Send all three completed puzzles in together.

Machine-Gun Movies

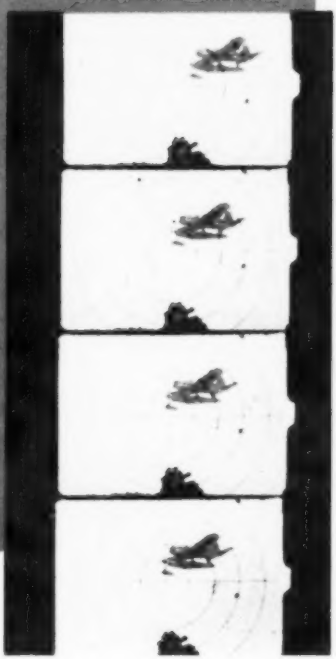
America's aerial gunners train for sharpshooting in the Main Event with the aid of fast-action cameras, which not only allow them to aim at "live" targets, but record their marksmanship on calibrated film.



Above: Camera guns come early into the training of a gunner, are used widely in plane-to-plane combat.

Left: An aerial gunnery trainee watches as the film that will record his aim is loaded into his gun-camera.

Above: What every good gunner hopes for —a Condor bomber square in the sights.



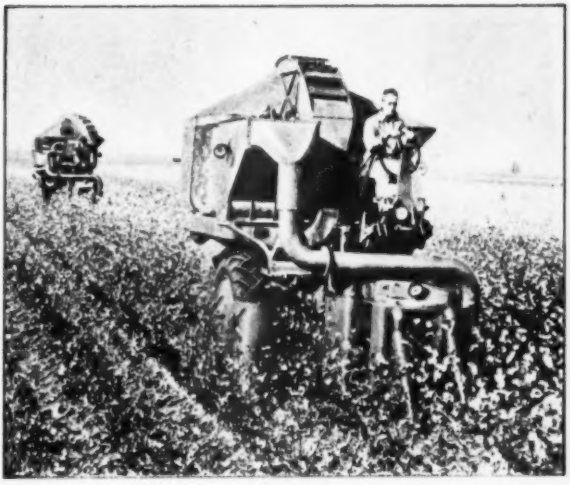
Right: Close, but no cigar. A series of near misses on gun-camera film. Cameras allow for "lead" on moving target

NEWS OF SCIENCE AND MECHANICS

NEW COTTON PICKER DESIGN FOR DEFENSE
A SERIOUS SLEEPER
SPITFIRE GROWS UP

A New Day Dawns For The Old Plantation

PICTURED on this page is a potential instrument of revolution—International Harvester's new mechanical cotton picker. Though a practical machine of this nature has been sought ever since Eli Whitney invented the cotton gin, only within the past few years have the combined efforts of many men succeeded in producing one. This newest model does a clean harvesting job, as can be seen at right, but its use must still be restricted to areas which have cotton gins able to handle a machine-picked crop.

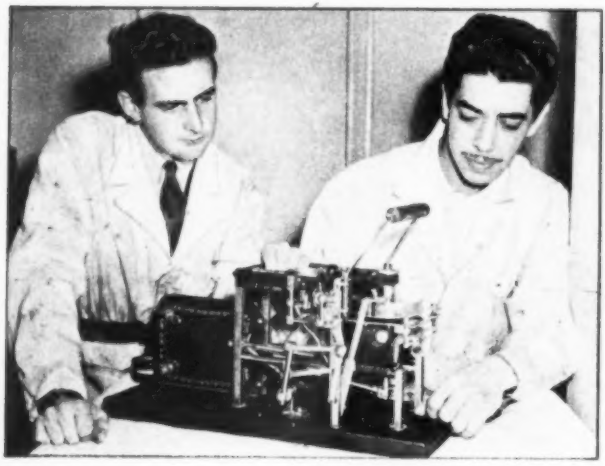


Wartime Manhole Cover

WHEN cast-iron manhole covers proved unobtainable for a large war housing development, the County Surveyor of Los Angeles decided to use wood. Here's the result, saving 250 pounds of metal on each cover, and an equal amount on each frame. The wooden covers are proof against termites.

No, He's Not A Diver

HE'S A sand blaster at the Boeing plant in Kansas, sweeping scales of dirt from the frame of a P-17 fuselage with a powerful blasting hose. The headgear, weighing 14 pounds, is worn as a safeguard against inhaling dust particles, has an air-supply line running to point outside the blasting chambers.

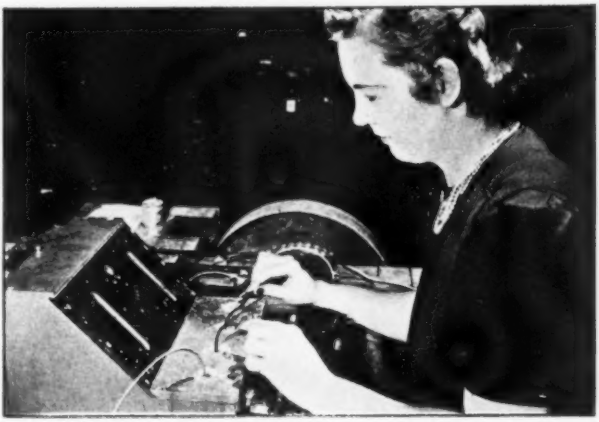


From Hamburgers To War Production

NOT long ago the two young men pictured at left, students at U.C.L.A., perfected their first invention—a machine that could turn out 300 pounds of hamburger patties in an hour. When war came they turned their ingenuity to aircraft instruments, to such good effect that they are now operating a war plant of their own, with a staff of 12 people. Here they take an affectionate last look, for the duration, at their hamburger "factory."

Flame-Thrower On The Production Front

THE tongue of fire from the factory flame-thrower at right is used at the Westinghouse laboratories to close the ends of high power radio transmitter tubes; as one of the big tubes rotates on a lathe, the flame melts the end of the glass bulb to make an airtight seal. The flame-thrower is known in the shop as a "cannon burner," provides a gas flame reaching a temperature of more than 1,000 degrees Fahrenheit.



Salt Water Tests These Circuits

THE girl shown at left is using the newest speed aid for testing complex electric circuits—plain salt water. Ordinarily, control box units for fluorescent lamps, on which she is working, have to be connected to four separate binding-posts on a tester for checking. Dropping the wires into cups of salt water has been found just as efficient as attaching them to binding posts, and much faster.

Now You See It— Now You Don't

A NEW method of building glass-brick walls is shown in the picture at right. The blocks are held firmly in place by means of prefabricated wedges, instead of by mortar, and the joints are covered at the sides by molding, also prefabricated. Once installed, a wall built like this can be moved about seasonally, or merely to change a room's appearance, at little or no cost.

Battle Fleets In Miniature

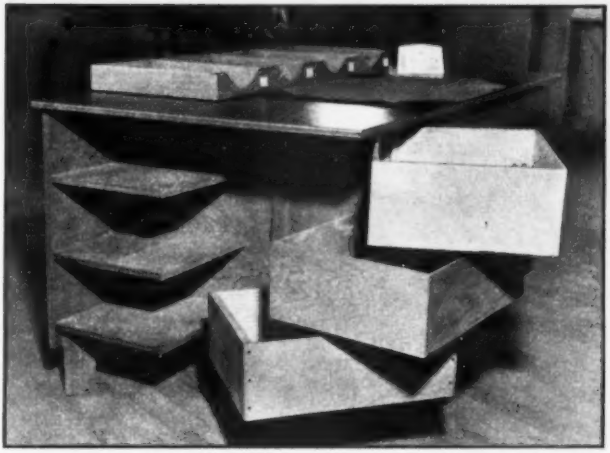
A GIRL worker at the David W. Taylor model building shop and testing basin in Washington, D. C., is shown above at left putting the finishing touches on some miniature warships for the U. S. Navy. These models are sent to the ships of the fleet, to be used for study by seamen and airmen as an aid to quick and accurate identification of the surface warcraft of all nations. The set of models pictured are of the Nazi pocket battleship *Scharnhorst*. Above right, in another part of the shop, workers smooth down the hull of a model of a Navy tug, which is to be tried out in the testing basin.

It Floats—But Don't Light A Match Near It

SHOWN at left is Vic Phillips of Capilano, North Vancouver, B. C., with a thoroughly tested example of his own invention—a seaworthy paper boat. The 10-foot boat consists of a cedar frame covered with 25 layers of heavy brown paper previously dragged through a glue bath; it weighs only 60 pounds, was built by Phillips himself in 12 hours at a cost of $4.00. In the water for 18 months, it has yet to spring a leak. Phillips has also developed a paper sandbag, in which he has interested the Canadian Army.

The Army Air Forces Get In The Scrap

PICTURED at right is an all-wood desk of the type being used at the Army Air Forces Combat Crew school at Tarrant Field, Texas, so as to conserve vital metal for more important war uses; even its swivel drawers have no locks or hinges. The Army Air Forces policy of using wood or other substitutes wherever possible in barracks and office furnishings is saving millions of pounds of steel for tanks and planes.

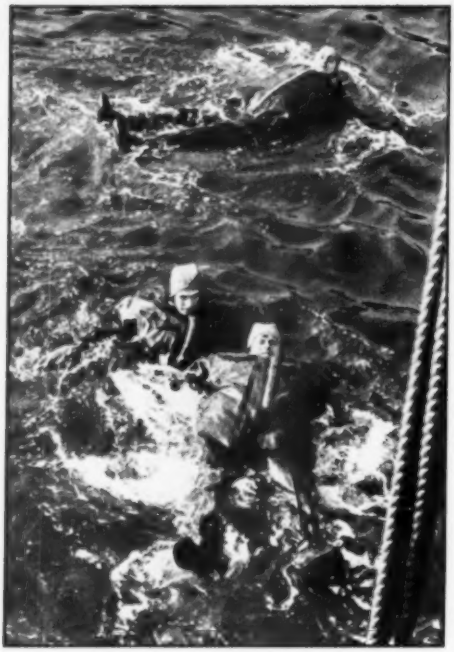


Step Up And Get Yourself A Shine

JOE MILONE, at left, dishes up one of his best shines for a customer, using "the most beautiful shoe-shine stand in the world," made by himself. Only a sparetime shoe-shiner, Joe started with just an ordinary stand, has spent much of his spare time for the past several years adding embellishments. Now he is enjoying a unique reward: his stand is on exhibition along with the works of Cezanne and other masters, in New York's Museum of Modern Art. "Joe Milone's shoe-shine furniture," says the Museum's director, "is as jubilant as a circus wagon."

Electric Gauges Speed Production

CHECKING the thicknesses of surface coatings of precision-machined plane and tank bearing parts, which must be accurate to a thousandth of an inch, is now done by portable electric gauges. These gauges, operating magnetically, can determine the exact thickness of any non-magnetic coating on a steel backing in a second or two, do not mar the part's finish.



Pinpricks Are Not In Order

THIS is not a picture of the Fat Men's Convention taking a dip, but of apprentice seamen, trying out the latest thing in life-saving suits. These lightweight, rubberized coveralls can be slipped on in a few seconds in an emergency, zip up the front to enclose enough air to buoy up a man.

Now It's Rubber Paint

DIE-CUT pads of felt like that pictured above, used for protecting the soldiers operating U. S. Army tanks, are now given a coat of synthetic rubber before being put into service. The rubber, sprayed on, guards the felt against the effects of moisture, without detracting from its resilience.

Dress Your Inner Tube In A Sweater

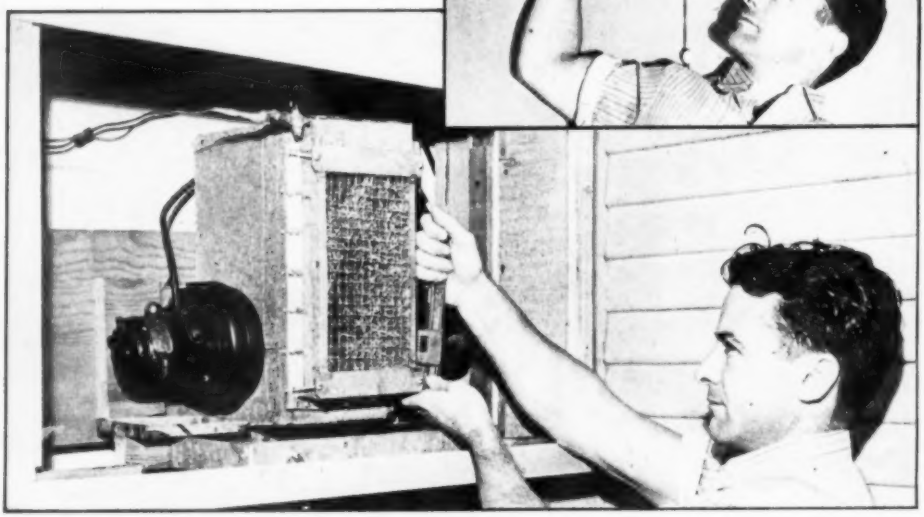
SNUGLY encased in a new cotton cord protector, the inner tube at left is being slipped into a tire which, because of the protector, will be able to go back into service once more. By a "sweater" like this, tires whose inner plies are broken so that they would badly damage an unprotected inner tube, may be saved from the scrap pile for further usefulness. The stretchable cotton covering is inexpensive, easily installed.

Ground-Bound Test Pilot

PICTURED here is the newest device for noting the performance of a plane being flight-tested—a radio flight test recorder recently perfected by the engineers of Vultee Aircraft. Unlike other electronic flight recorders (MECHANIX ILLUSTRATED, February, 1943) this one does not go aloft with the plane, but gathers its data by radio from 70 vital points at once and writes them all down in a ground laboratory. Advantages, besides the obvious one of freeing the test pilot from paperwork: a better picture of the plane's performance can be obtained from one flight than was formerly possible to get from 10 or 20 flights; if dangerous stresses should develop in the plane, the technicians on the ground can often know it before the pilot at the controls, and can warn him; if the plane should fail and the test pilot have to bail out quickly, full data on the failure will be safe on the ground. Above, ground technicians check the test of a model in flight 100 miles from the laboratory. Right, aerial unit being loaded into a test plane.

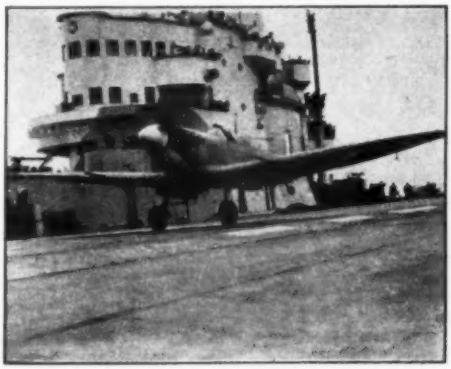
THE SERIOUS SLEEPER

WHEN Joseph Landless, Los Angeles night watchman, wants to sleep, he really wants to sleep. What's more, he does something about it, as the pictures on this page show. At left is the entrance to his sleeping chamber—a seven- by three-foot space partitioned off in his bedroom, just big enough to hold a bed; the entrance is equipped with a sliding door, so that the bedroom-within-a-bedroom can be completely shut off. It is thoroughly soundproofed. It is air-conditioned (bottom picture) by a blower which pulls in air from outside, filters it of dust, cools it with water or heats it. Below, the air vents inside the chamber, and the reading light—in case Joe doesn't feel sleepy.



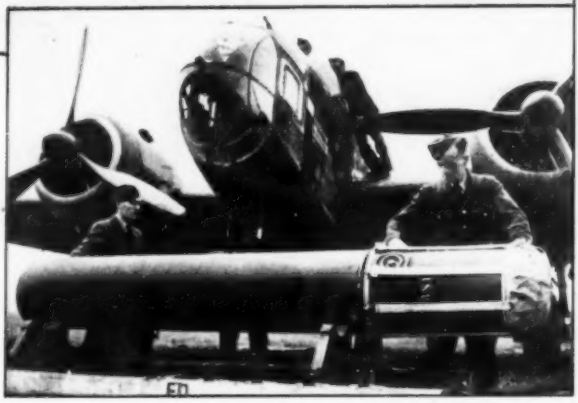
The Spitfire Grows Up In Three Years Of War

ON THIS page are the first released picture of the newest model of Britain's great fighter plane, the Spitfire, and pictures showing how it has developed under the stress of three years of aerial war. At top is the new Spitfire; below right, the "Spit" as it was in 1939, when Hitler launched his attack on Poland. At right is the intermediate model, designed on the basis of the experience gained during the air war over England, which drove the Axis from the air over Egypt. Below left, the Spitfire's newest sea-going relative, the carrier-based "Seafire."



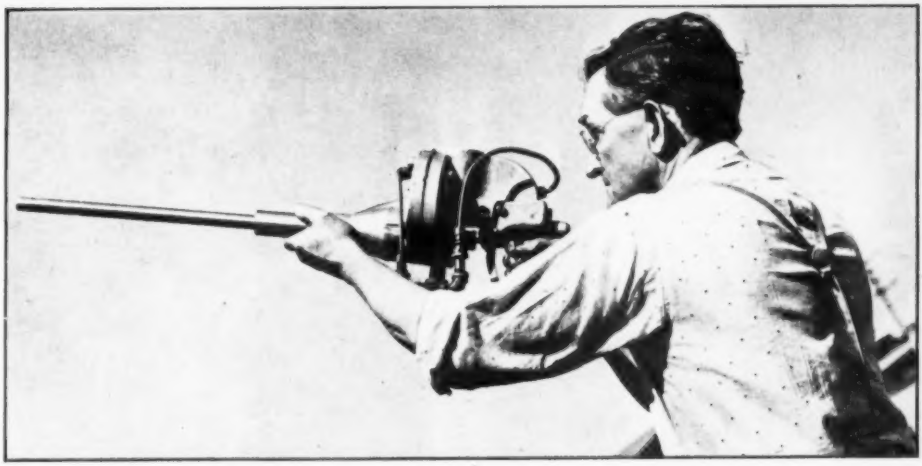
Sowing Death For Axis Ships

IN THESE newly-released pictures from England a Handley-Page Hampden mine-laying plane is shown, at right, being loaded with its "eggs"; at top, off on its deadly mission. These planes lay mines in paths of enemy shipping which cannot be reached by the surface craft of the Royal Navy.



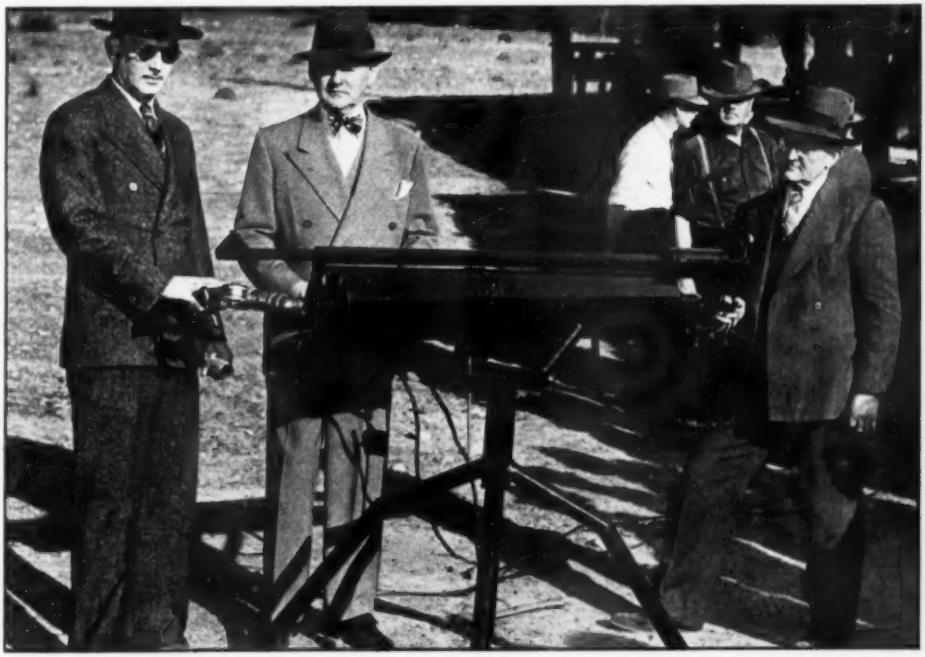
All Dressed Up And Someplace To Go

THIS is how the rear gunner of a heavy bomber dresses up, before setting out on an operational mission. His equipment: 1, helmet; 2, oxygen mask and microphone; 3, oxygen tube; 4, inter-communication lead (for communication between members of the aircraft's crew in flight); 5, dog-clips for chest-type parachute; 6, "Mae West" air-inflated life jacket; 7, tape ties for "Mae West"; 8, quick-release box on parachute harness; 9, webbing of parachute harness; 10, fur collar of lambswool-lined leather flying jacket. The gunner's very life may depend upon the quality and condition of this gear—even on the warmth of his clothing, if enemy bullets should shatter his enclosure at a sub-zero altitude.



Something New In Air Power

SHOWN here is the new "mystery gun," invented by W. B. Hale, chief engineer of the Dix Manufacturing Co. of California, which uses no gunpowder at all, and, according to the claims of its manufacturer, can fire as many as 12,000 rounds of .50 calibre ammunition a minute. The firing force is compressed air; hence the gun makes no flash to betray its location, makes almost no noise, and even has no recoil. No data are available on the gun's muzzle velocity, effective range or other specifications, except that its overall weight is about 300 pounds, and it can be operated by one man. At top, Mr. Hale demonstrates the weapon's barrel and firing chamber; below, the gun fully assembled.



Transport For War

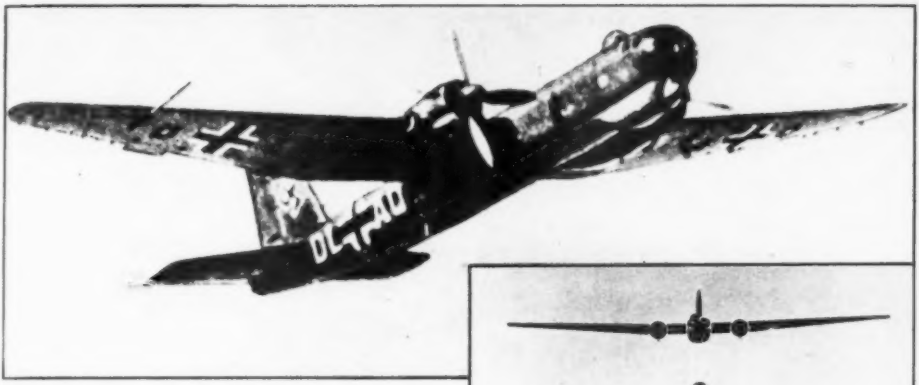
SHOWN above is the first to arrive in England of a new type of locomotive, known as the "Austerity." According to the British Ministry of Supply, these locomotives can burn "any kind of fuel," have wheels adjustable to any gauge track.

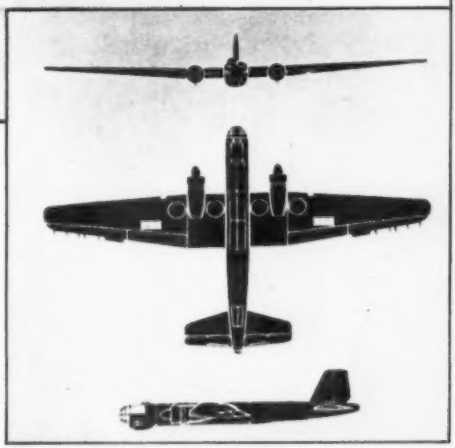
Fight Fire With Gas

A NEW robot fireman for U. S. combat planes is the ingenious "impact switch" shown above. This switch automatically discharges several pounds of carbon dioxide into the engine compartment when a plane crashes, smothering any flames.

Warplane Motors Get Chemical Towels

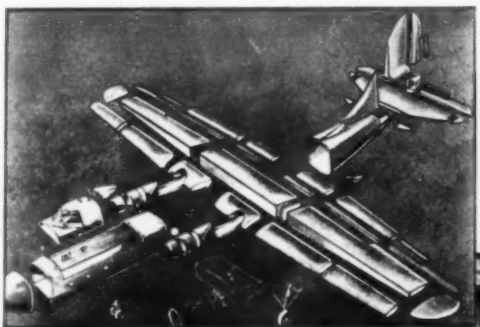
THE workers at left are giving a Wright engine a secondary line of defense against moisture, in case its wrapping of cellophane should be broken. A bag of silica gel, a crystalline mineral which absorbs water, is tied to each cylinder, cartridges containing the gel are placed in the sparkplug openings and oil pump; so that no trace of moisture may rust vital parts.

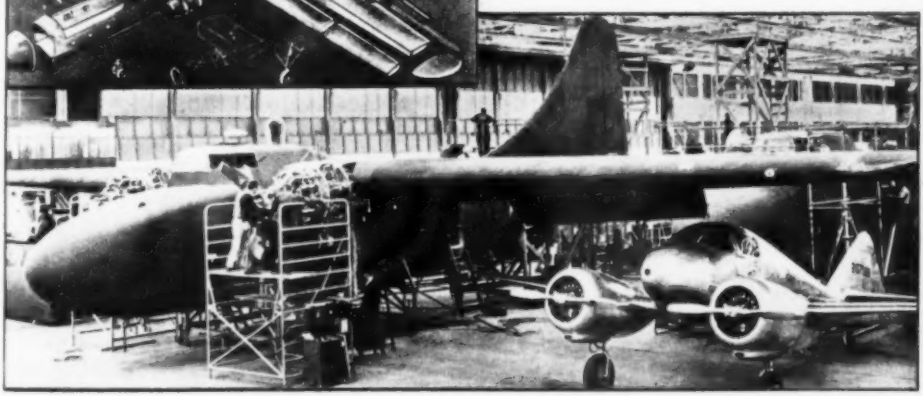




Spitfires Get A New Target . . .

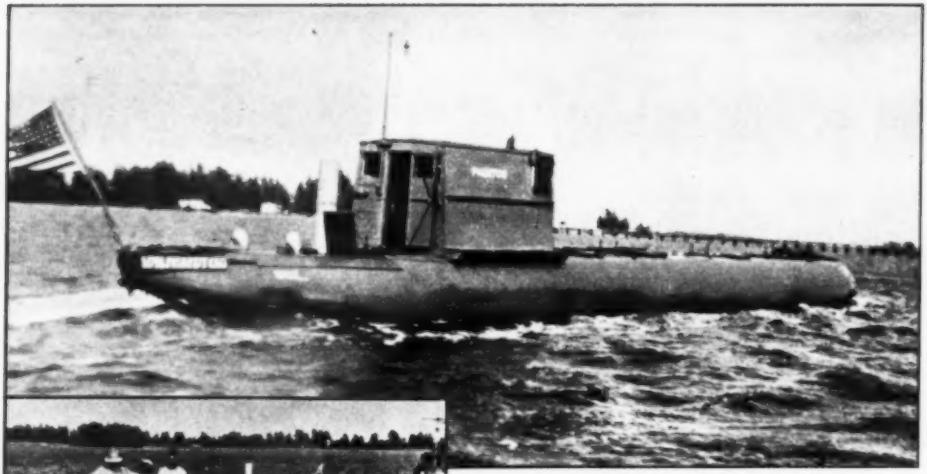
PICTURED above is the newest addition to the Luftwaffe's family of heavy bombers—the Heinkel HE177. Though powered by four 1,500 h.p. Mercedes-Benz motors, it is classed as a two-motored plane because the engines are housed in pairs, in two nacelles. Its span is 103 feet, length 64 feet. Bomb-load, speed and range have not yet been determined; even the official identification silhouettes are partly guesswork, for these bombers are so new that few of them are yet in service.

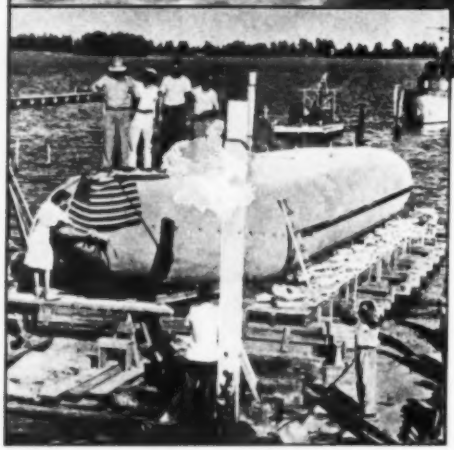




. . . And The U. S. Army Gets A New Transport, Built Of Wood

BELOW, a C-76 Curtiss Caravan, the U. S. Army's newest aerial transport. Built almost entirely of wood, the Caravan has a span of 108 feet, a length of 68 feet, is powered by two 1,200 h.p. motors. Left, a breakdown drawing of its main parts.





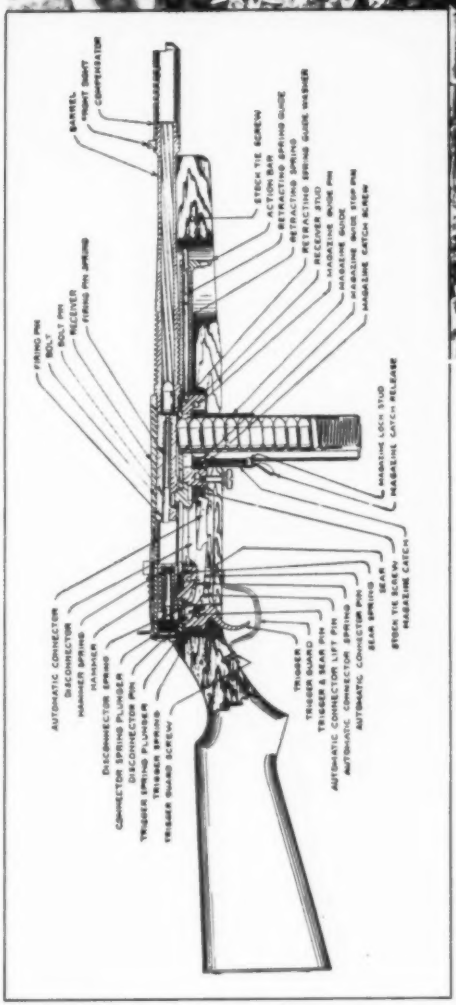
A Concrete Phantom . . .

SAILING briskly through inland waters, above, is a revolutionary type of vessel known as the Phantom of the Sea. Built of concrete, the Phantom is operated entirely by radio, carries no crew (the deckhouse on this one, a test model, is temporary); it is intended to travel in convoys of ten or more, all controlled by one master escort ship. Building now is a larger Phantom, 260 feet long, with a cargo capacity of 2,000 tons, capable of making ocean voyages. Left, a small Phantom is launched.

. . . And A Wooden Mosquito From Canada

PICTURED at left is the Canadian version of Britain's famous Mosquito reconnaissance bomber (MECHANIX ILLUSTRATED, January, 1943). Built of wood, this plane is a natural end-product for Canada's huge lumber industry, can be constructed in about half the time required to build an all-metal bomber. A feature of the plane is its stressed-skin construction; the wings are wooden throughout, with spars and ribs fitted together in a rigid structure from tip to tip, covered with thin, tough plywood. Though performance characteristics of the Mosquito are secret, it is known to be highly maneuverable.

SEVEN POUNDS OF SUDDEN DEATH

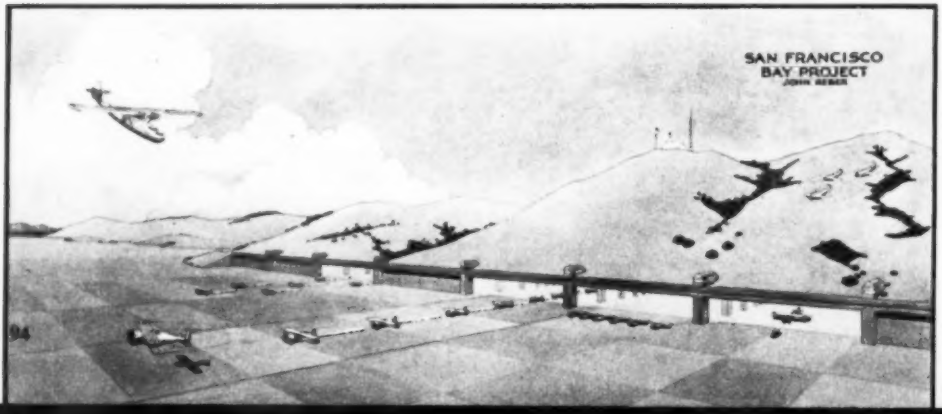


PICTURED and diagrammed on this page is the latest addition to the list of weapons officially adopted by the United States Marine Corps—the H&R Reising submachine gun. Using standard .45 caliber ammunition, this gun, with a muzzle velocity of more than 900 feet per second, can drive a bullet through six inches of white pine at 20 yards. It is effective against a human target at ranges up to 300 yards, can fire at Full Automatic adjustment more than 400 rounds a minute, or can be set to fire one shot at a time with automatic reload. Advantages claimed for this weapon include not only light weight and compactness, but virtually foolproof operation, for the Reising has only three moving parts, and can easily be disassembled and reassembled in the field. Also, when held properly with a light grip, the Reising will not "buck" even when being fired at full automatic; vents on top of the barrel near the muzzle (see diagram at left), allow chamber gases to escape upward under pressure, forcing the muzzle down and keeping the gun steady. Diagram is of the Reising Model 50, for ground troops.

Above left, a map of San Francisco harbor, showing proposed dams and filled-in area; *right,* John Reber, originator of the plan, explains it to a Congressional committee.

SUPER-HARBOR FOR FRISCO

TO MAKE San Francisco and its great harbor not only impregnable to any enemy attack, but to increase tremendously San Francisco's value as a peacetime port, has been the dream of John Reber, West Coast consulting engineer, for more than 10 years. Announced last spring, his plan for doing this, so vastly conceived that before Pearl Harbor it would doubtless have been dismissed as wildly visionary, has won enthusiastic comment from engineers, local officials and Congress alike. It comprises: two dams each four miles long; two surface airports; a naval base; a combination terminal for commercial airplanes, trains and busses; fifty miles of new dock sites; six ship locks; 20,000 acres of reclaimed land. Cost of the project is estimated at $117,000,000.



CRAFTS AND HOBBIES

Modern Houses of Earth. See page 104.

PHOTOGRAPHY • MODELS • RADIO
THE HOME WORKSHOP • HOUSEHOLD
KINKS • SCHOOL SHOP • BOATS
WOOD AND METAL WORKING • TOYS

BROME ETCHING

by

Leon B. Urvant

Above: A quality print finished by the simple brome etching process. Rough surfaced paper like the Opal Z used here produces the best results.

BROME ETCHING is a simple method by which ordinary picture material can be invested with salon-print quality. The advantages over ordinary black and white prints are many.

Brome etching increases the tone range by clearing the highlights and lightening shadows. It imparts a beautiful olive tone to photographs on white paper and a light brown tone to those on buff, unlike that which any special developer or toner can possibly produce. The feeling of sharpness is increased because the surface layer of silver is removed. The picture lies in the paper itself.

Enlarging papers best suited for this process are those that have a definite rough surface such as Defender Veltura P or Q or Eastman Opal Z. The usual print control may be employed with this process. The use of smooth papers is not advised because they tend to develop uneven streaks during the etching operation.

Begin by making up the following stock solutions:

Solution A

Salt	2 oz.
Sulphuric Acid, conc.	½ fl. oz.
Water	13 fl. oz.

Solution B

Potassium Permanganate	½ oz.
Water	10 fl. oz.

Working solution: 15cc. Solution A and 15cc. Solution B in 32 oz. water. When making your stock solution be sure to pour the sulphuric acid into the water not the other way around or your solution may boil and spatter.

Your druggist will make up these solutions for you at low cost if you do not wish to mix your own solutions.

[*Continued on page* 156]

Left: The two components of the working solution are mixed while the "over-developed" and unfixed print is soaking in plain water.

PHOTO CONTEST

FIRST PRIZE ($10.00): "Letter from Australia" by Dr. I. K. Moorhouse, 601 American National Bank Building, Beaumont, Tex. Taken with a 2¼x3¼ Speed Graphic, on Plus X film, developed in DK-20; f/22, 1/100th second. SECOND PRIZE ($5.00): "Glamour?" by Jack Garber, 308 East Fifth Street, Brooklyn, N. Y. Taken with a Rolleiflex, on Plus X film, developed in Minicol; f/4.5, 1/00th second. Two floods used. THIRD PRIZE ($4.00): "Little First Aider" by Dr. I. K. Moorhouse, 601 American National Bank Building, Beaumont, Tex. FOURTH PRIZE ($3.00): "32 Ozs. of Dynamite" by Ralph Levkanich, Box 97, Curtisville, Pa.

Submit prints for this month's contest unmounted—no larger than 8x10 inches. With each print list your camera, film, lens, opening and shutter speed, illumination, and developer. Write your full NAME and ADDRESS on the back of each print, and wrap securely with cardboard or corrugated stiffeners. If you want unused prints returned, you must enclose return postage. (Published prints cannot be returned.) Address: Photography Editor MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y.

1st PRIZE

2nd PRIZE

4th PRIZE

3rd PRIZE

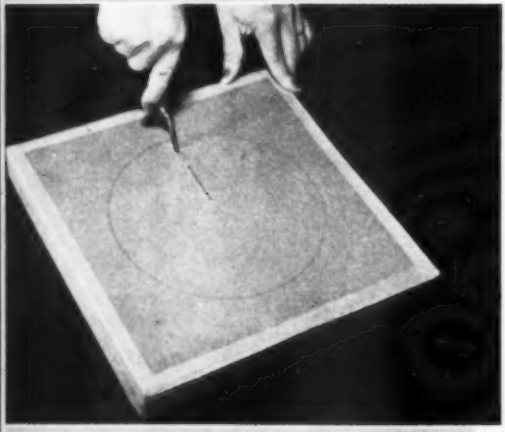
SIMPLIFIED F

by Victor Brown

Fig. 1 *(above)*: The flash tester in use. The flash lamp is fired so that part of the beam enters the lens and part goes into the uncovered hole in the box cover.

PROPER flashgun synchronization was never as important as it is today. Amateurs are now working on the meager reserve supplies saved for a "rainy day." The dealers' shelves have been cleaned out, with the exception of limited quantities that can be reached only with priority orders. Actually, proper synchronization has always been a problem of the flash photographer, for slight inaccuracies inevitably lead to serious underexposure; large ones, to complete failure.

How to detect synchronization failures? A quick and accurate tester is needed. The simple outfit described in this article is easier to work than many that have been suggested before—and it is as accurate as any designed to date. It works with focal plane as well as between-the-lens shutters.



The tester consists of a revolving turntable (phonograph) supporting an 8-inch diameter sheet of bromide paper, over which a box-shaped cardboard cover is laid. A slot and hole are cut through the top of this cover, as shown in Figure 2.

A portable phonograph makes an excellent turntable as long as it can rotate at a consistent rate of speed. The box-lid cover should be large enough to fit loosely over the turntable (Figure 3) and lie flush against the flat of the phonograph top. The top of the cover should be as close to the turntable as possible without touching it.

Fig. 2 *(above)*: The slot and hole are cut along the same radius of the 8-inch (diameter) circle scribed on the box cover. When the box cover is placed over the turntable for the test, the circle corresponds to the position of the 8-inch circle of bromide paper previously placed on the turntable.

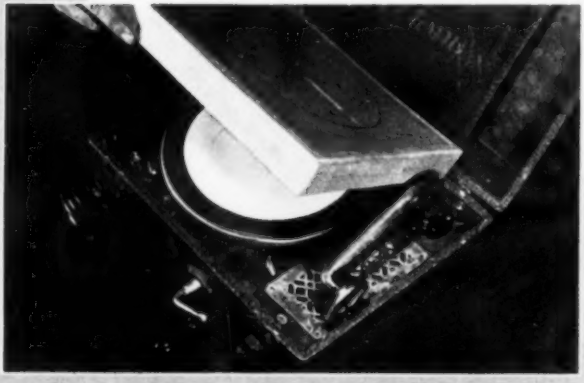
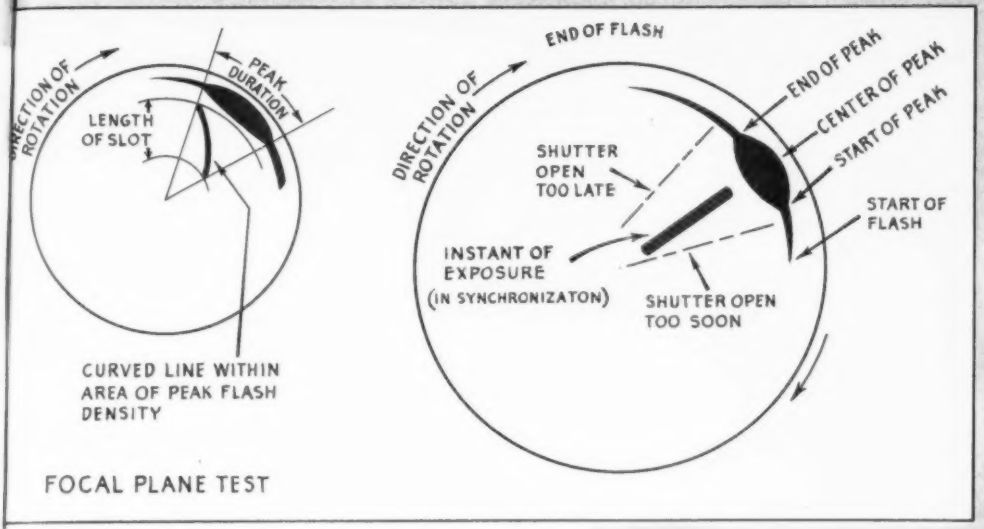


Fig. 3 *(right)*: How the box cover with the slot and hole cut along one of its radii is placed over the turntable with an 8-inch circle of paper placed on top the latter—entire operation is executed in darkroom.

D FLASH-PEAK TESTER

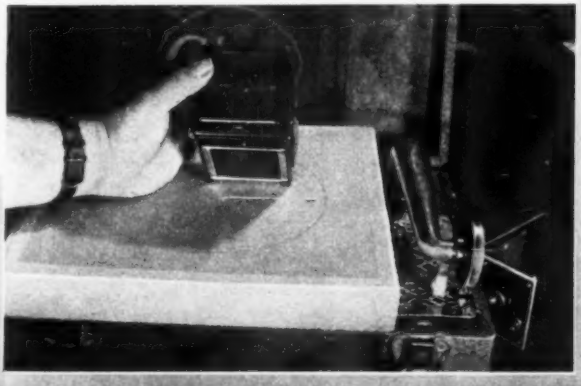


FOCAL PLANE TEST

From the center of the top of the box cover, describe an 8-inch diameter circle to correspond with the position of the bromide paper on the turntable beneath it. Then cut a slot through the cover along the radius line of the circle, its length being slightly narrower than the width of the film used in the camera to be checked. A little further along the same line, but closer to the edge of the circle, cut a small ¼-inch hole through the lid.

Now, to check your synchronizer, step into the darkroom, cut an 8-inch circle from an 8x10 sheet of bromide paper, and place this, emulsion side up, on the turntable of the phonograph. Then cover the turntable with the lid cover. The camera, with its back either removed or opened, should now be laid over the slot on the cover, so that its open back rests directly over the slot, as shown in Figure 4. The small hole in the lid should be left uncovered alongside the camera.

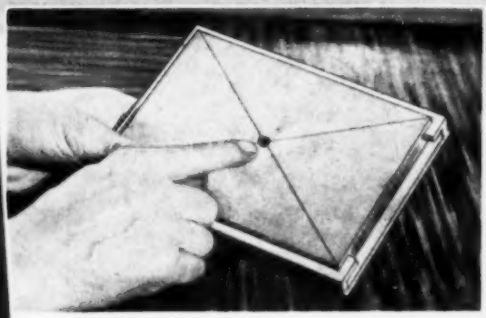
Now, set the synchronizer [*Continued on page* 156]



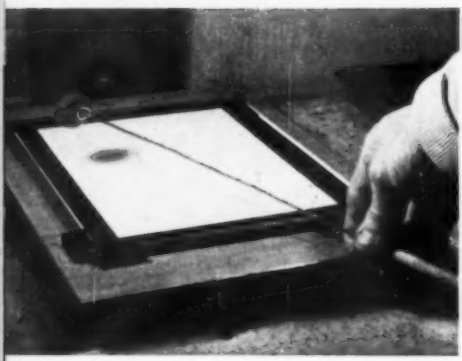
Above: Synchronization test made at 1/25th second. *Below:* 1/300th second.

Fig. 4 *(left):* The camera is placed over the slot with its back removed; the hole in the same radius is left uncovered.

KINKS FOR CONSERVATION



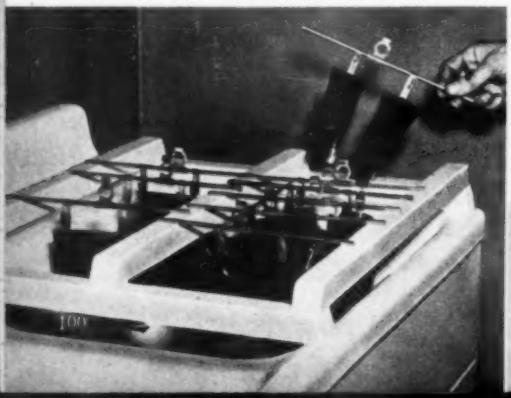
Left: If you've ever had occasion to use a tilting easel with an enlarger, you can very easily adapt one for the purpose by using a tripod fitted with a tilt-top as shown here. *Above:* For installation of the tripod bushing, diagonal lines are drawn from top to bottom of paper holder. At point of intersection, a 3/16-inch hole is drilled nearly all the way through. This is then tapped with standard tripod thread.—*L. T. Beggs.*



Left: A round paper clip soldered at the end of a strip of wire provides a quick and easy way to change sizes and shapes of opaque dodging disks in enlarging. —*George Carlson.*

Right: Here's an economical Kodachrome transparency file made from cardboard and a sheet of corrugated paper. Box is 2¼ inches wide and 2 inches deep. The grooved corrugated channels in the box will accommodate mounted transparencies and permit easy access to them. —*Louis Hochman.*

Below: To avoid dripping from negatives in the darkroom, make this portable negative rack which fits over the top of a darkroom or kitchen sink. Materials consist of a few lengths of 1x1 lumber, some small nails, and a little paint. Rack will easily hold 40 to 60 negatives.—*Duane Featherstonhaugh.*



Below: Aluminum boxes for filing processed film are out of circulation for the duration. A good substitute, however, is the cardboard container shown purchased inexpensively at any drug store. These cardboard packers are slightly smaller in diameter, but very strong and serviceable.—*W. E. Musick.*

PHOTO-MAGIC with Black Backgrounds

FIG. 1 *(above)*: This striking result was obtained by posing model against black background. Plate was placed close to her neck, and black paper used to cover rest of body. In addition, camera was situated low to complete the weird effect.

by Serge Balkin

TRICK photography is a form of photographic diversion that, somehow, never becomes dull and uninteresting. It holds a certain fascination for amateurs and professionals alike, who, every now and then, relax from their routine picture taking by attempting to produce the impossible, photographically. Some photographers work out their trick effects by involved methods, while others produce equally effective trick pictures by the simplest means.

One of these simple means consists of taking advantage of the fact that black does not register on a photograph unless it is brilliantly illuminated at an angle. Any subject posed against black and partly covered with black material will have only its uncovered portions reproduce on the film. It is easy to see that many unusual trick effects can be accomplished on the basis of this simple principle.

FIG. 2 *(right)*: Effect obtained by placing black cardboard in front of the two models as shown in Fig. 7, bottom page 103.

FIG. 3 *(left):* "Four-handed Indian Goddess" was done by posing two models against black background; one in rear, other in front. Fig. 4 *(above):* How it was done.

For instance, observe Figure 3, which depicts a four-handed Indian Goddess. Since four-handed goddesses are difficult to find, I accomplished the trick by posing two models against a black background, one behind the other, with the one in the rear holding her hands in front of the foremost one, as shown in Figure 4. However, to prevent the rest of the rear model from showing in the picture, I had a large sheet of black paper held in front of her face, as shown in the same illustration. Since both models wore black apparel, only the light hands and face were recorded on the film.

The simplest and most economical black background to use is black paper, obtainable in large, heavy sheets measuring about 24x36 inches. You can get it at most art supply stores at a cost of from 5 to 10 cents a sheet. Several of these sheets tacked against the wall will form a suitable dark background, and a few extra sheets can be used to mask out areas of the composition which you do not wish to show in the resulting picture.

"Salome," Figure 1, was a very simple trick. The model was posed against the black background, and a plate was held close against her neck. The rest of her body was covered with a sheet of black paper, and the camera placed at a low angle recording the scene in a very realistic manner.

"Floating in Mid-Air," Figure 5, was accomplished by having the model posed not only against a black background but also upon one. Black sheets were laid out on the floor and the model's bench was placed on these. The black background on the wall was extended

FIG. 5 *(left):* "Floating in Mid-Air," produced by placing model on and against a black background; black paper on floor.

FIG. 6 *(right)*: This illustrates how the addition of smoke as a prop adds a proportioned degree of mystery to a well planned, black-background setup.

down to meet, and blend with the one on the floor.

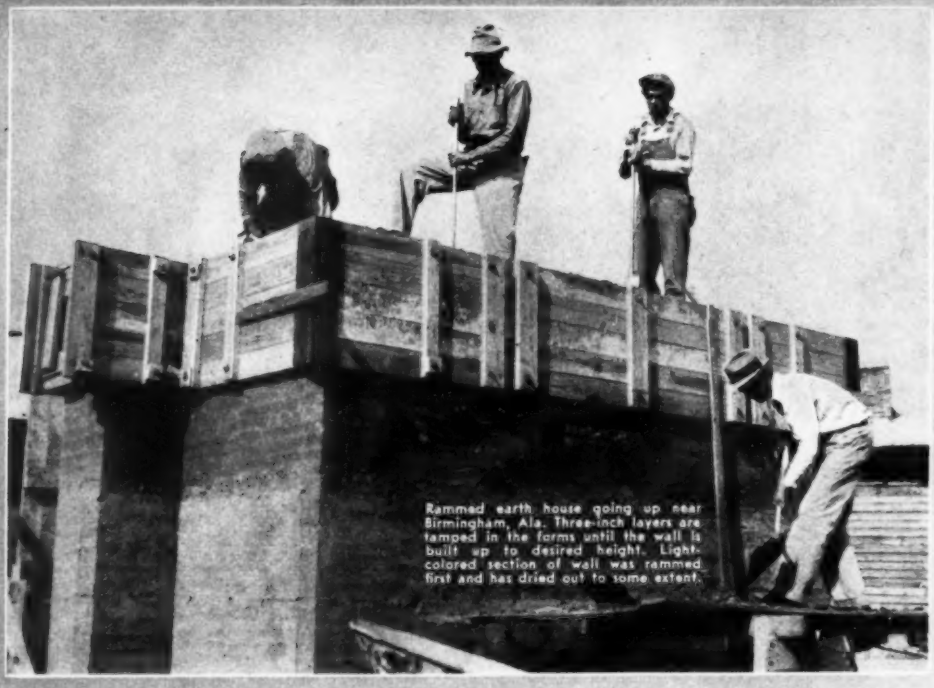
There are practically no limits to the variety of effects you can produce by the general methods outlined above. If you want a headless person, hold a black card in front of his head. If you want a man's head on a woman's body, pose the woman against the black background, cover her head with a black card and make an exposure. Then without moving the camera, have the man stand in the spot vacated by the woman, so that his head will occupy the identical spot her head did. Now, cover his entire body up to his neck with black material and shoot another exposure on the same film.

The result will be amazing and amusing.

Since, as we noted before, black does not normally photograph, there is no reason why you can't make more than one exposure on the same piece of film by posing a model against the portion which was covered with black material in each "previous" exposure. In fact, you can take as many pictures as you like on a single film, so long as you do not pose anyone in the same spot twice. You can even pose the same model more than once on the same film and thereby get the effect of identical twins or quadruplets.

It is a good idea to avoid the use of any more lights than are necessary to outline the shape and details of the principal subject, for excessive lighting will pick out the texture of your black background and masking materials, giving away your trick. Your exposure should be just adequate to record the principal subject, while the print exposure and development should be balanced to achieve the maximum black of the printing paper without fogging the highlight and halftone areas. In the latter connection, the use of test strips will be found most desirable. And to make sure that that the test strips give a true indication of the exposure time that produces a good rich black and clear highlights, use a developer that has not been exhausted—at a temperature of 70° F.

FIG. 7 *(right)*: Explanation of Fig 2, page 101. Black cardboard covers parts of body that are not supposed to register.



Rammed earth house going up near Birmingham, Ala. Three-inch layers are tamped in the forms until the wall is built up to desired height. Light-colored section of wall was rammed first and has dried out to some extent.

MODERN HOUSES OF EARTH

With the aid of chemistry and up-to-date methods, one of the world's oldest types of dwelling construction becomes one of the newest.

PART I

HOW would you like to own a modern home that's completely fireproof, soundproof, automatically insulated against heat and cold, safe from termites, rats, mice and other vermin—a house that will last so long that even your grandchildren won't be stuck for repairs, yet costs less than the cheapest frame construction; a house that can be as beautiful as any you've seen?

You can have such a house, and furthermore you can build it yourself if you have average health, strength and intelligence. Best of all, it can be made almost entirely of non-priority materials.

Below: Partly completed "stabilized" rammed house. Window and door frames are of wood, set in as ramming progressed.

by Richard W. Haupt

Above: Front view of a three-bedroom rammed earth house built at Gardendale, Ala., by the Farm Security Administration. A combination of three parts sand, two parts clay and one part coarse earth was used for the walls. *Right:* Walls of rammed earth resemble rough concrete before finishing. As time passes they harden, becoming virtually monolithic.

This isn't a pipe dream of the future—it's an actual fact of today; yet you're probably wondering how any house could possibly combine all the qualities just described—certainly not a brick or wooden one. The answer is simple; so simple you'll ask yourself why nobody thought of it before. The answer is, in fact, right under your feet—the Good Earth. And somebody did think of it before; thousands of years ago.

Every race of man since the beginning of time has used earth in building homes and shelters. Primitive savages used mud to hold together their reed huts. In Mesopotamia archaeologists have discovered recently earthen bricks which date back at least 4,000 years. Earthen towers were used in the Roman War in 200 B.C. The oldest house in America was made of earth in 1556 in St. Augustine, Florida, and is there today for you to visit. How's that for durability! In California there stand adobe missions built by the Franciscan Padres over 150 years ago. An example of these is the San Juan Capistrano Mission which was erected in 1776.

A dry climate isn't necessary, either. Properly waterproofed, your earth house will stand anywhere. In Illinois a two-story earth-

This house in Washington, D. C. was built in 1773 of rammed earth. Portico and extensions at rear were added at a later date.

brick farmhouse, erected during the Civil War, is still being used by the descendants of the original owner. Dr. H. B. Humphrey, a government scientist, made himself an earth house near Washington, D. C., in 1922. Professor N. F. Menefee of the University of Michigan constructed a very satisfactory one in Ann Arbor, Michigan, in 1926. These are a few shining examples for you to consider.

Now for the cost! Most of your material is free on the building site. The soil excavated for the basement will be sufficient for the exterior and interior walls of a house and garage. Six inches of soil from the surface of a lot measuring 50′x100′ is adequate for a six-room house. An asphaltic emulsion stabilizer must be mixed with the soil to strengthen it and make it waterproof. For a house of this size, the stabilizer shouldn't cost you more than $100. The only additional items you need buy are: concrete for a foundation; lumber for floors, etc.; plumbing, heating and electrical equipment; hardware and decorating materials. A few wooden forms and rammers are needed to work the earth.

For strength, your earth walls will be hard to beat. Laboratory compression tests show that the average newly made wall will carry loads of 500 to 600 lbs. per sq. in. or about 40 tons per sq. ft. This value compares to that of kiln-dried brick. Moreover, as the years pass the walls will harden more and more until they finally become as solid as stone.

They are perfect insulators against heat, cold and sound, too. The rooms are cool in the summer, and in the winter your fuel bill will be small because all of the heat will be kept within the walls. Perfectly soundproof,

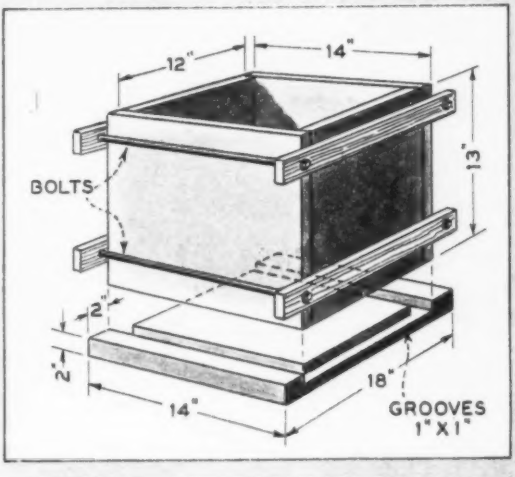
they also serve to keep out objectionable noises and you can play your radio in the living room without bothering Junior in the bedroom. If you make the floors and roof of fireproof materials, the entire building will be fireproof, for these walls offer perfect protection against this hazard, and you'll save quite a bit in fire insurance, too.

Rats and mice can't gnaw through stabilized earth walls and vermin don't like them. Termites will look up more tasty quarters.

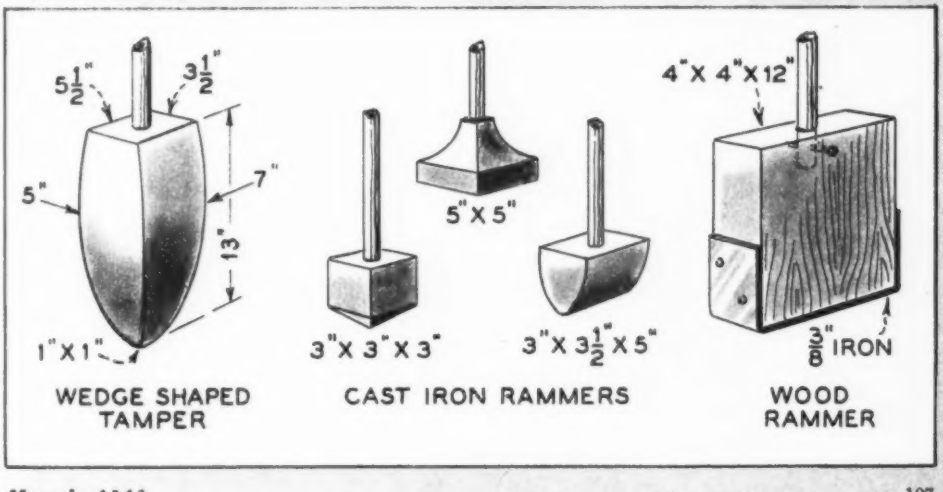
In appearance earth dwellings rival those made of wood or stone. Many of the beautiful brick and stucco-appearing houses you can see in your travels through the Southwest are in reality built of earth. It is easy to make the exterior of your earth wall resemble brick or stucco or you can even paint it if you so desire. The interior surface can be plastered or hung with wallpaper. They're rather attractive when left in their original condition, showing the natural soil coloring.

You can take your choice of two building methods, both of which have been proved satisfactory. You can use asphaltic stabilized earth [*Continued on page* 154]

Above: Rammed earth test form and a cube of earth which was tamped in it. This testing is necessary before construction. *Below:* How test form is made.



Below: Typical rammers used on earth walls.

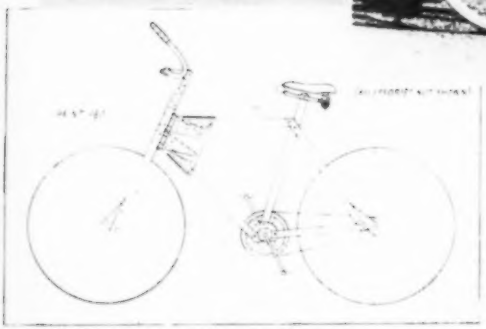


BUILD YOUR OWN BICYCLE

by Robert Wheeler

New bikes are "frozen" for the duration, but you easily can make one from non-priority materials.

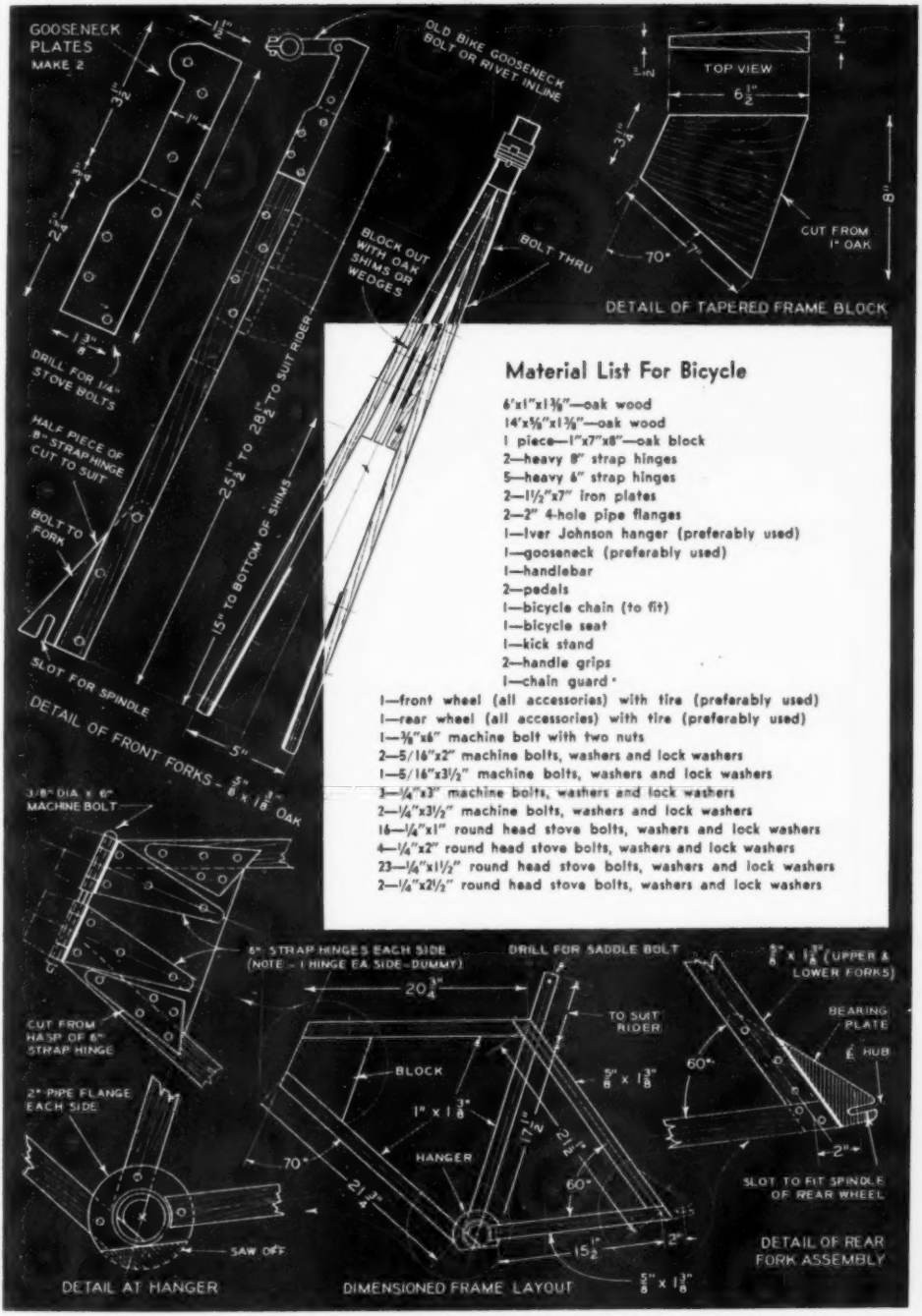
Above: The finished bike, ready to roll away. *Right:* You don't worry about such foibles as fenders on this sturdy, lightweight job. Saddle, wheels, handlebars and sprocket are standard and may be purchased second-hand without priority number. *Below:* Profile of the bike. Hinges hold steering column.



DAVE BAER, engineering student at Stanford University, may have solved your transportation problem, for he has designed and built a sturdy wooden-framed bicycle made entirely of non-priority materials. The design is so simple that anyone who has an average amount of intelligence and even a slight knowledge of the use of tools can build the bike at a cost considerably lower than that of a similar bicycle before the war.

The frame is designed for use with the standard racing wheel, the victory size wheel, or the old 28-inch high pressure type. Second-hand wheels and tires in one of these three sizes should be available to the average home builder with little trouble, and the cost for the entire job, without the wheels and tires, should be in the neighborhood of $12, using all new parts. Second-hand parts may lower this cost by as much as $4.

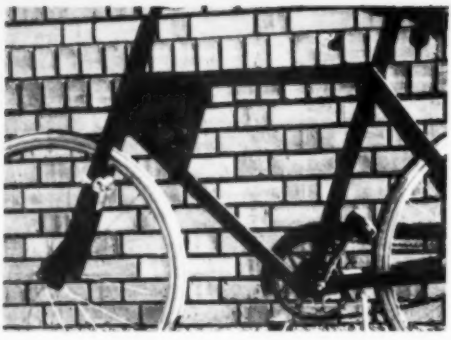
After the necessary materials are assembled (see list), one hole should be hacksawed off each pipe flange as shown in the diagram. While the exact line of cutting is not particularly important, it must be remembered that the two plates must be cut upon exactly



Material List For Bicycle

6'x1"x1⅜"—oak wood
14'x⅝"x1¾"—oak wood
1 piece—1"x7"x8"—oak block
2—heavy 8" strap hinges
5—heavy 6" strap hinges
2—1½"x7" iron plates
2—2" 4-hole pipe flanges
1—Iver Johnson hanger (preferably used)
1—gooseneck (preferably used)
1—handlebar
2—pedals
1—bicycle chain (to fit)
1—bicycle seat
1—kick stand
2—handle grips
1—chain guard
1—front wheel (all accessories) with tire (preferably used)
1—rear wheel (all accessories) with tire (preferably used)
1—⅜"x6" machine bolt with two nuts
2—5/16"x2" machine bolts, washers and lock washers
1—5/16"x3½" machine bolts, washers and lock washers
3—¼"x3" machine bolts, washers and lock washers
2—¼"x3½" machine bolts, washers and lock washers
16—¼"x1" round head stove bolts, washers and lock washers
4—¼"x2" round head stove bolts, washers and lock washers
23—¼"x1½" round head stove bolts, washers and lock washers
2—¼"x2½" round head stove bolts, washers and lock washers

Drawing shows construction details and necessary measurements. Materials needed are listed in center. For best results frame should be laid out full size and all the dimensions and angles verified before cutting. Particularly important is the fact that the frame dimensions given in plans and text are measured from center to center and are not overall dimensions of the members.

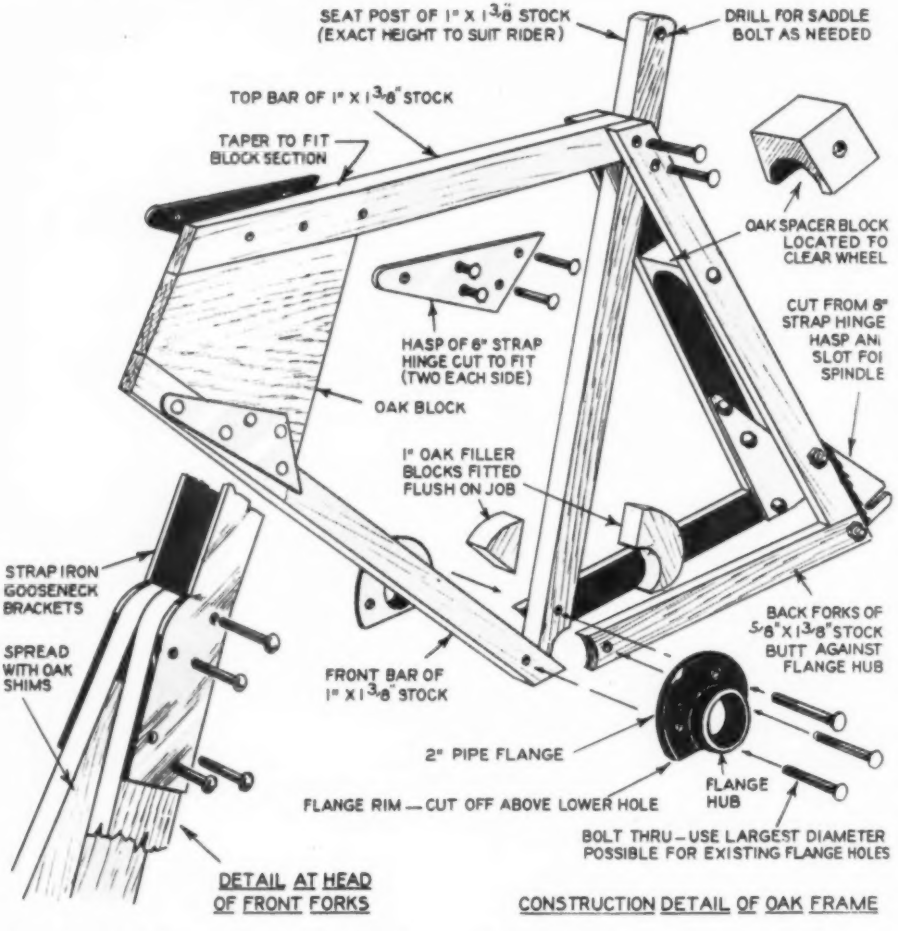


Pipe flanges are used as hanger for sprocket and for sturdy bearing. Seat height is not adjustable and must be predetermined. Adjust standard bike then transfer measurements.

the same line, so that the wooden blocks which will be used later to close up this opening may fit snugly.

Next, for the rear forks (vertical) two pieces should be cut from the $\frac{5}{8}$" oak, with the angle at one end of each 60° and at the other 55°, giving each (stick) approximately the shape of a parallelogram. Then from the same lumber, two more boards are cut for the horizontals (diagram gives dimensions). Just as the first two boards had 60° angles on one end, so do these, but the other ends of these two are rounded out so that they will fit snugly to the rim on the pipe flange (see diagram of hanger assembly).

For the front forks, two more pieces are cut from the [*Continued on page* 158]


SEAT POST OF 1" X 1 3/8" STOCK (EXACT HEIGHT TO SUIT RIDER)
DRILL FOR SADDLE BOLT AS NEEDED
TOP BAR OF 1" X 1 3/8" STOCK
TAPER TO FIT BLOCK SECTION
OAK SPACER BLOCK LOCATED TO CLEAR WHEEL
CUT FROM 8" STRAP HINGE HASP AND SLOT FOR SPINDLE
HASP OF 8" STRAP HINGE CUT TO FIT (TWO EACH SIDE)
OAK BLOCK
1" OAK FILLER BLOCKS FITTED FLUSH ON JOB
STRAP IRON GOOSENECK BRACKETS
SPREAD WITH OAK SHIMS
BACK FORKS OF 5/8" X 1 3/8" STOCK BUTT AGAINST FLANGE HUB
FRONT BAR OF 1" X 1 3/8" STOCK
2" PIPE FLANGE
FLANGE HUB
FLANGE RIM — CUT OFF ABOVE LOWER HOLE
BOLT THRU — USE LARGEST DIAMETER POSSIBLE FOR EXISTING FLANGE HOLES
DETAIL AT HEAD OF FRONT FORKS
CONSTRUCTION DETAIL OF OAK FRAME

This perspective sketch shows how frame is assembled with bolts and filler blocks. Bottoms of flanges are sawn off with hacksaw.

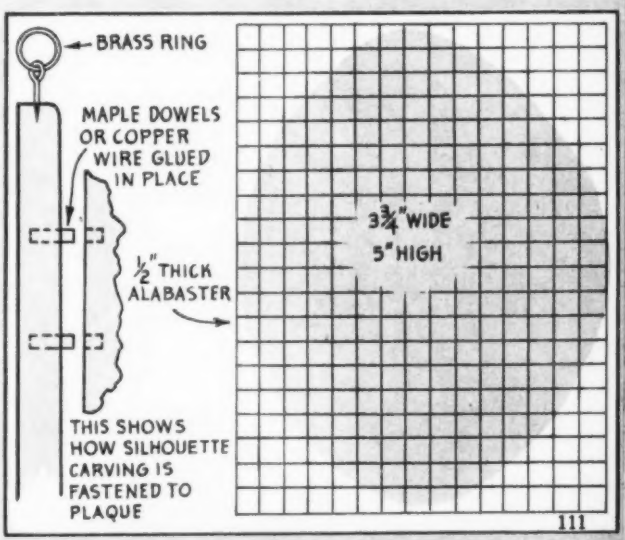
ALABASTER CARVING

In the above photo the young lady is carving a silhouette, using a sharpened nail file. At *right* are completed plaques with heads of Lincoln and girl.

YOU can saw, sand, rout and otherwise work alabaster just as you can plaster of Paris and almost as easily as you can any soft wood. You can carve it into permanent, attractive articles, one type of which is shown—wall plaques on which are mounted silhouettes of the same material.

Tools may be improvised. The tool the young lady is using in one of these photos, was made from a discarded nail file. Only the end was worked over to provide a scraping edge on one side and a slicing edge on the other side of the point. Regular carving tools are, of course, even better, and because of the softness of alabaster, the cheaper sets will do just about as well as those more expensive.

The projects shown comprise oval plaques 3¾ inches wide and 5 inches high of slabs of alabaster about ½ inch thick. These slabs can be sawed from large chunks of alabaster with a hand saw or on the band saw with the metal-cutting blade. A regular wood cutting blade will work but will dull quickly unless the speed is reduced. This done, jig saw out the plaques, then sand the most attractive side [*Continued on page* 160]


BRASS RING
MAPLE DOWELS OR COPPER WIRE GLUED IN PLACE
½" THICK ALABASTER
3¾" WIDE
5" HIGH
THIS SHOWS HOW SILHOUETTE CARVING IS FASTENED TO PLAQUE

IDEAS for SERVICE MEN

Cpl. Sam Greenberg, Camp Lee, Va., has found the following ideas useful and wants to pass them on to other service men:

In typing of military correspondence certain designated margins are required according to Army regulations. To save time and effort take a small pack of bond paper (25 to 50 sheets), riffle the edges and then run a pencil over the edged pack. This will leave a slight pencil mark on edges of each sheet of paper at the required spot. Thus, a whole batch of sheets may be marked for their respective margins at one time.

Don't throw away that small box or cardboard container that housed the sewing kit—you can use it to hold all your clean handkerchiefs. This improvised kerchief container won't take up much room in your locker, bag, etc., and will keep the nose wipers conveniently in one spot when needed.

The empty metal container which housed a typewriter ribbon can come in handy as a barracks ash tray . . . . or use it to keep paper clips in if you're assigned to an Army post office or headquarters.

Here's one from Pvt. Herman L. Capooth, Fort Sill, Okla., that will be particularly useful to the boys in O.C.S., where neatness plays a big part in getting that commission:

Quoting Private Capooth. "I have found that occasionally on inspection day I have misplaced some toilet article, and am caught short before I can find it. To avoid such an occurrence, I obtained a small cardboard box in which I put all the articles required for inspection, and placed the box in my locker. Now I never have to rummage through my locker when inspec rolls around."

Private Ben Knott of Camp Davis, N. C., has the following suggestions:

When sleeping in tents in wet, chilly weather, with no heating equipment available, the bedding often becomes damp and cold. This condition may be remedied by filling the canteen water bottle with hot water, if there is a barracks nearby. If not, the water could be heated over an open fire. Placed under the bed covers the ersatz hot water bottle helps dry the bedding and keep the soldier comfortable.

On long marches in very hot weather the head may be kept cool by stuffing leaves in the helmet or hat. Fresh, green maple leaves seem to be best, for some reason.

Here's an idea from David Deutsch, of Brooklyn, N. Y., that should get some kind of a prize, though just what would be appropriate we don't know. Maybe a pound of corn silk coffee would do 'er. Anyway, here goes:

"When I send away a package to a friend in the Service, I want to be sure that it is adequately protected against bumps and rattling. So I fill any empty spaces in the box with *popcorn*.

Tissue or newspaper have nothing on popcorn as a rattle-stopper and breakage-preventer, and the lad receiving the package can have a wonderful time eating the stuff. His buddies may think he's a bit nuts at first, but they'll soon catch on and line up for the hand-out."

P.S.: If the popcorn itself rattles, try pouring in a little molasses.—*Ed.*

Private T. D. Thurman, Ft. McClellan, Ala., offers the following:

Cooks and K. P.'s, who cut butter, can prevent it from sticking to the knife blade by slipping the waxed paper in which the butter was wrapped around the knife's blade.

All leather articles, personal as well as service, should be frequently looked after, in order to preserve them against the rigors of duty and weather. A good rubbing down with saddle soap or light oil every once in awhile will do wonders for them, regardless of kind of leather or use.

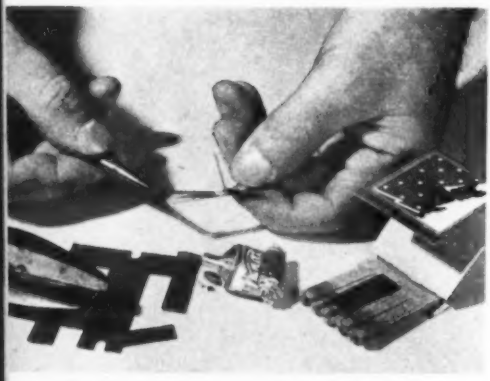
SERVICE MEN ATTENTION!

This is your department, and if you like it enough to want to make it better, you can. It's all up to you! Send in your ideas—anything you think may help your buddies in the Army, Navy or Marines. You'll be helping yourself too, because MECHANIX ILLUSTRATED pays from $2.50 up for material used. Address "Ideas For Service Men," MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y.

MYSTIFY WITH MAGNETS

These are a few sensational tricks with which you can fool even the "wise guy."

The bases of magnetic toy dogs are excellent for these effects.

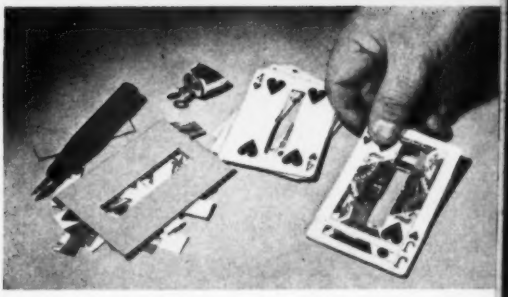


by Ken Murray

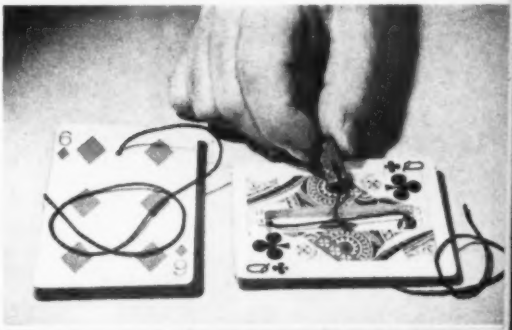
THESE tricks are particularly suitable for amateur presentation because they require little or no skill—each illusion practically working itself because of the unique magnetic principle employed. Although you can carry all of them in one pocket with convenience, they are not in the pocket-trick class because each is exceptionally startling and inexplicable. Practice each illusion several times privately so that the "moves" become natural, and then you can fool successfully the wisest member of an after-dinner or club audience and soon acquire a reputation as a sleight-of-hand artist.

Above: For "Penetrating Match" trick, narrow strip of thin iron is embedded in paper match. Magnet is fitted in place in match book. *Left:* When match book and coaster have been removed, one match is seen to have penetrated the bottom coaster. *Below:* The performer is apparently able to select envelope containing the Canadian nickel by smell

The cord is pulled through the holes in a deck of cards to show it is apparently continuous, yet deck can be cut in two.



Above: Cards with openings are glued together to form two thin packs. Each contains a magnet. *Below:* How magnet and cord are placed in position. Rivet serves as pulley.

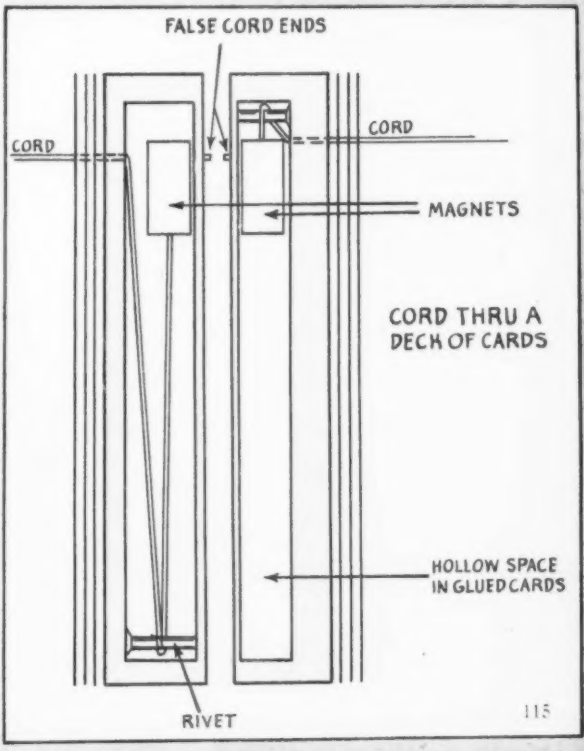


Each effect makes use of one or two tiny magnets. "Alnico" (alloy metal) magnets, which pack a lot of power in a small package, are best. In most cases the same one can be used for several tricks. The small magnetic dogs, sold in department and novelty stores, have bases which are excellent for the purpose. These are variously known as "Hot Doggies" or "Snooty Pups." The cost is generally 10 cents each. The illustration shows an assortment from which the magnets have been removed.

The Penetrating Match

A book of paper matches is taken from the pocket and two of the matches removed and placed on the table and covered with a cardboard or plastic beverage coaster. The match book is placed on the coaster. The latter is lifted so that another coaster can be dropped over the matches. Now you apparently have an arrangement of two matches covered with two coasters with the match book on top. Lift off the match book and then the top coaster. Underneath the latter and on the bottom coaster is one of the matches, which seemingly has penetrated through the coaster itself!

This trick is startling and you must try the above moves to fully appreciate it. It works it-



The drawing shows positions of the two magnets and strings when halves are joined.

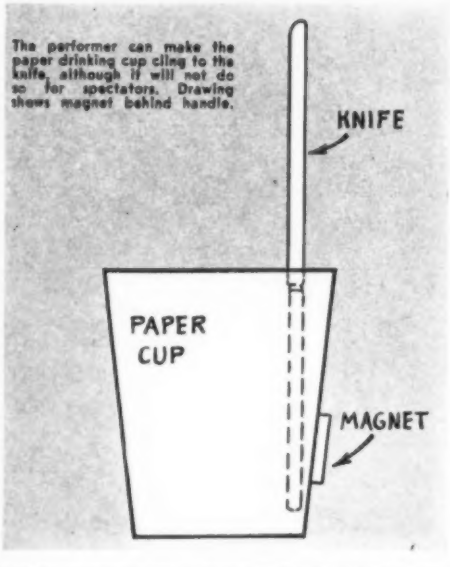
HOW MAGNETS WORK

A magnet is a piece of iron or steel which has the ability to draw to it other pieces of similar metal. Natural magnets, found in iron ore deposits, are called "lodestones." These are irregular in shape while manufactured magnets are usually made in the form of bars or horseshoes. When a bar magnet is suspended by a string tied to its center, one end will point to the Magnetic North Pole of the earth and the other will point to the Magnetic South Pole. This is the principle of the magnetic compass. The ends of the magnet are also called poles—north and south respectively. About the poles there exist magnetic lines of force which compose the "magnetic field." These lines of force cause magnetic attraction.

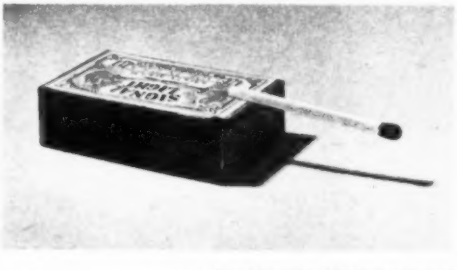
A piece of iron may be magnetized very easily by stroking it with another magnet or by placing it in a coil of wire through which a direct current is flowing. When a magnet is broken, each separate piece becomes a magnet. It may be demagnetized by heating or striking with a hammer.

All matter is composed of tiny particles, called "molecules," which fit together like bricks in a wall. When iron or steel is magnetized, its molecules (which are tiny magnets themselves), line themselves up with their north poles pointing one way and their south poles pointing the opposite way. Demagnetizing consists in shaking them up and scrambling them.

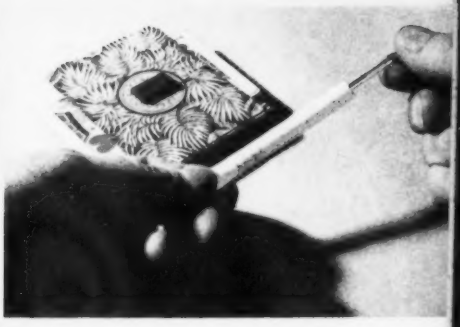
Permanent magnets hold their magnetism for a long time and are made of hard steel. They are used in compasses and electrical measuring instruments. Temporary magnets, made of soft iron, are used in telegraph instruments, simple motors, doorbells, etc. (Further information on magnets may be found in The School Shop section on page 141.)


The performer can make the paper drinking cup cling to the knife, although it will not do so for spectators. Drawing shows magnet behind handle.
KNIFE
PAPER CUP
MAGNET

self. Three matches are removed from the back row of the match book to accommodate a magnet, which is cemented in place. One of the paper matches is split, a narrow and very thin strip of iron (or a piece of steel needle) is inserted and the match is pasted back together again. It and a plain match are the ones used. When you place the first coaster and match book over the matches, the prepared match clings magnetically to the underside. Lifting this coaster also lifts the match and the second coaster is placed over the unprepared match. Before lifting the top coaster, remove the match book. This is one of the few tricks that can be repeated with little chance of detection, and it becomes more and more puzzling to your audience. Have a spare book of matches on hand in order to make a switch if anyone should wish to examine the material afterwards. Make your moves rapidly and no one will ever get wise to them.



Above: Magnet is inserted beneath match box drawer. *Right.* Piece of steel needle in match will balance it on box.



Left: "Sliding Glue" is the reason why the cigarette clings to the deck of cards. *Above:* A steel needle in cigarette and magnet held back of card is secret

Sense of Smell

Distribute small coin envelopes to the members of your audience and have each one seal inside his envelope a nickel. One should be a Canadian nickel; the others United States coins. When the envelopes have been shuffled and handed to you one at a time, you can instantly determine which envelope contains the Canadian nickel merely by smelling it. At least, that is the misleading explanation you give. In reality you have a magnet clipped between two fingers. The Canadian nickel is the only one that will be attracted by the magnet because it contains a small percentage of iron. Another miracle has been performed!

Cord through a Deck of Cards

Here is another of those rare tricks you can do over and over again—your audience becoming more mystified each time. The principle is really very clever. A little preparation is required but the trick is worth it. The effect consists of a cord threaded through a hole in a deck of cards. When you pull one end of the cord, the other end shortens, and vice versa. However, at any time you can separate the deck into halves, holding them wide apart and showing that the cord is severed. Replacing the halves together, the cords pulls through, back and forth, exactly as if it were whole.

The drawing shows how the deck is prepared. Use any old [*Continued on page* 162]

Above: For "Dead or Alive" trick, steel bearing is rolled in slip containing the name of the dead person. A magnet and ring does the rest.

The "Rising Card" effect is shown at the *left*. When cards are touched with a pencil, selected card will rise.

Each card is split for short distance and steel wool is cemented inside as at *right*. Magnet is in cap of pencil.

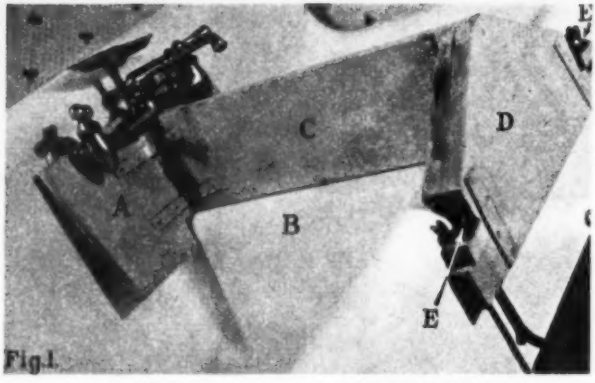


Fig.1.

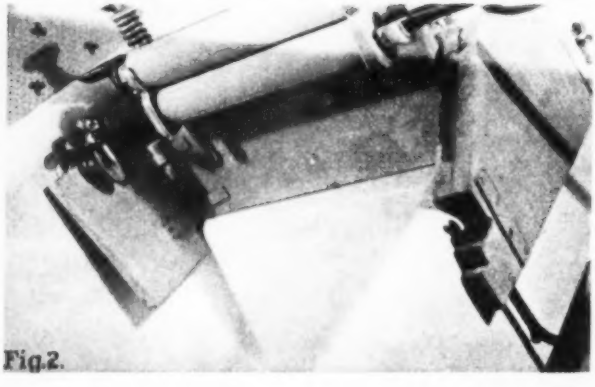


Fig.2.

HANDY CLOTHES WRINGER

EVERY housewife knows that clothes wrung by hand require at least twice as long to dry as clothes put through a sturdy wringer . . . and that hand wringing is a tedious job. But apartment dwellers without laundry room facilities usually must do without a full-sized wringer for the lack of a place to fasten one.

With clothesline space at a premium and drying time important, a simple bracket has been devised that can be made to fit any combination kitchen sink and laundry tub fixture, that fastens solidly without marring the sink and that is easily put on and taken off simply by loosening two wing nuts. All that is required to make this device is a few feet of 1"x8" clear lumber, eight dime-store strap-iron braces, two 5/16" bolts two washers and two wing nuts . . . plus a few simple tools.

The steps are: First cut the back board (A, Fig. 1) about 6" longer than the width of the faucet fixtures; notch it to fit snugly under the faucets and over the sink divider (B) as shown—a pattern cut out of thin cardboard will help get the notches right; then cut the crosspiece (C) at the proper angle to [*Continued on page* 164]

HEAT FROM TIN CANS

WHAT? Burn tin cans in your furnace. That idea is harder to believe than the one about goats eating tin cans. But seeing the tin cans being burnt and enjoying the warm comfortable home were evidence that the suggestion warranted consideration.

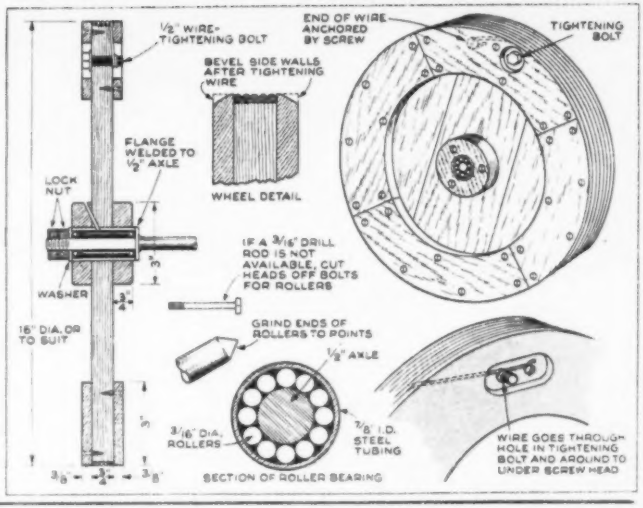
Extra interest in the unusual idea came from being shown the reduced coal bills. Over $25 had been cut from a $150 bill in one winter. An idea that saves $25 is worth the time any man around the house will spend in finding out about it. In many localities tin cans will not be accepted as scrap, so this idea provides a substitute use that is both patriotic and practical.

The burning of tin cans to save coal is a positively proven practice. It was developed just to fix up a mistake made by a coal delivery man. He dumped on Saturday three tons of buckwheat size hard coal into an empty bin instead of bringing the usual nut size. So Sunday there was nothing else to do except burn buckwheat or let the family freeze.

Unfortunately furnace grates designed to burn coarse coal allow fine coal to sift through. Fine coal shoveled onto a burning fire of coarse coal burns for a short time. But as soon as the coarse coal turns to ashes, the fine coal fire drops down out of the [*Continued on page* 164]

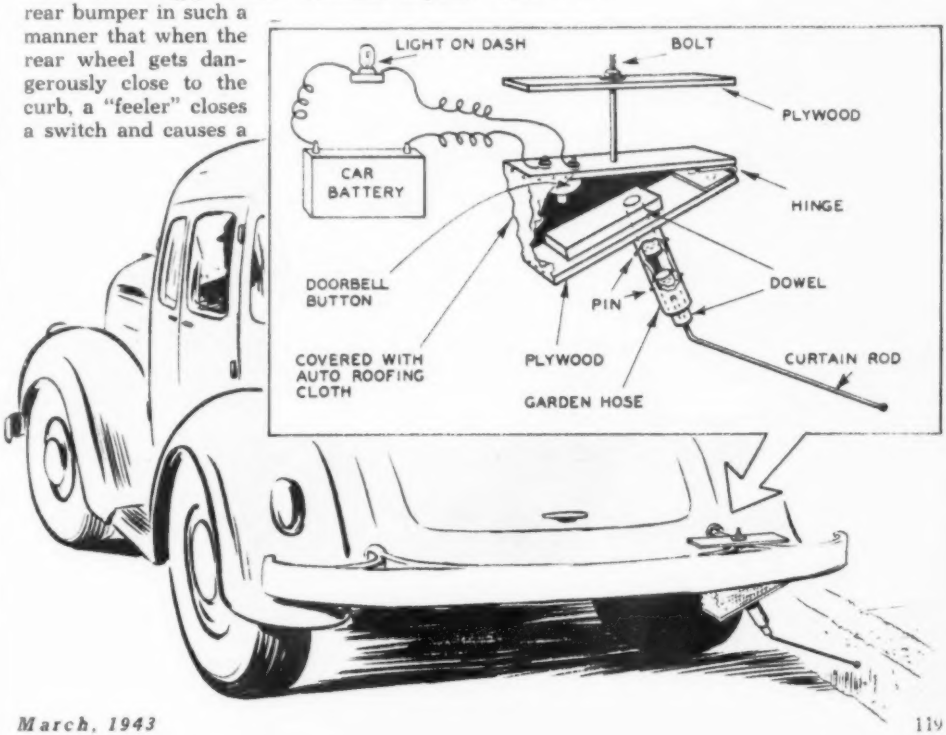
"Priority Wheel" With Wire Tires

WHEN small disk wheels are not available for sidewalk coasters, wheelbarrows or other home vehicles, here is a sturdy substitute that can be made almost entirely from cast-off material. The durable tire consists simply of several strands of bailing wire wound around the rim and drawn snug and taut by means of a bolt and socket wrench. When tightened as much as required, the loose end of the wire is given a turn around a screw recessed into the sidewall. The latter is made up of four segments of ⅜" wood screwed and casein-glued to the central flange which in turn is built up of three pieces of ¾" pine or other [*Continued on page 174*]


½" WIRE-TIGHTENING BOLT
END OF WIRE ANCHORED BY SCREW
TIGHTENING BOLT
BEVEL SIDE WALLS AFTER TIGHTENING WIRE
WHEEL DETAIL
FLANGE WELDED TO ½" AXLE
LOCK NUT
WASHER
IF A 3/16" DRILL ROD IS NOT AVAILABLE, CUT HEADS OFF BOLTS FOR ROLLERS
GRIND ENDS OF ROLLERS TO POINTS
16" DIA. OR TO SUIT
½" AXLE
3/16" DIA. ROLLERS
⅞" I.D. STEEL TUBING
WIRE GOES THROUGH HOLE IN TIGHTENING BOLT AND AROUND TO UNDER SCREW HEAD
SECTION OF ROLLER BEARING

Automatic Parking Gauge

IF YOU own one of the newer "blind" cars normally requiring a whole crew to park it safely, or if your wife is a right-rear-tire-scuffer, you'll find the gadget illustrated below exceedingly useful. It's bolted to your rear bumper in such a manner that when the rear wheel gets dangerously close to the curb, a "feeler" closes a switch and causes a light to show on the dash. Thus warned, you can pull forward and straighten out for another try at the parking space. Your tires and temper will both benefit as a result. Detailed sketch shows how the thing is made, what it's made of, and electrical wiring layout.—*G. D.*



PROTECTIVE ALARM SYSTEM FOR YOUR HOME

by Walter E. Burton

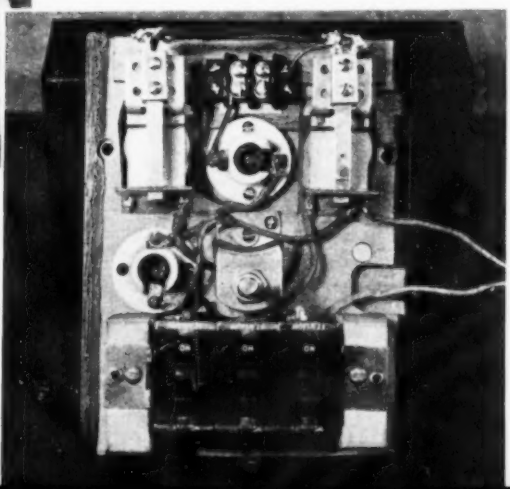
When an intruder opens a door or jimmies a window this "silent watchman" will suddenly wake up and clamor for attention.

Illustrated above is the control box of the alarm. All wires to it are concealed. Mount it in a handy spot in the kitchen.

THIS system, as easy to build as the simplest radio receiver, operates on the closed-circuit principle. The protective circuit, carrying a very small current, runs through doors, windows, etc., in such a way that opening or tampering with these will interrupt the current. Such interruption operates a relay that rings the bell. The bell will keep on ringing, even after the door is closed or the circuit otherwise restored, until a switch at the main control box is operated.

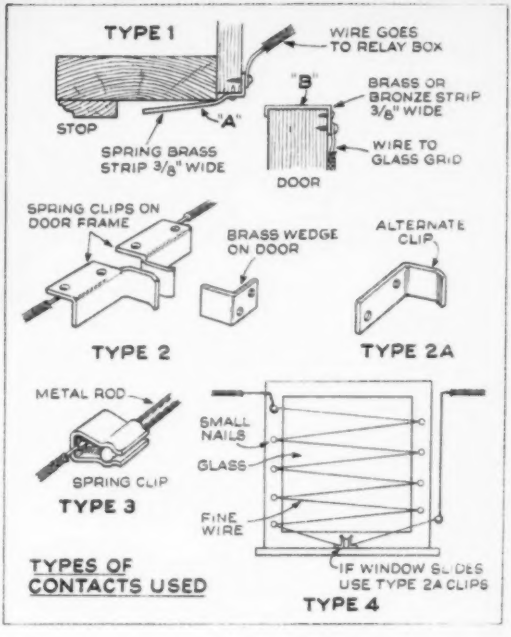
The alarm illustrated operates from a 6-volt automobile storage battery which is recharged every month or so. It could be operated by a rectifier unit, or the battery equipped with a trickle charger. If alternating-current relays

Above: Assembling the control unit, showing type of relay used. Base is made of two pieces of plywood.



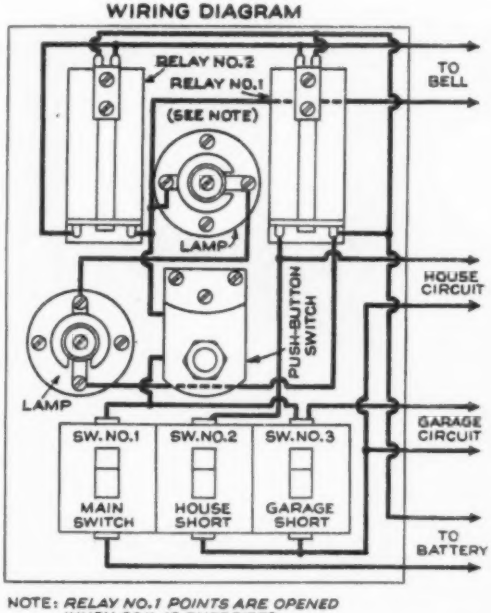
Right: Interior of control box. Wires to house and garage are not shown. Wiring diagram is on next page.

In the photo above and the diagram at the *right* are shown typical contacts and clips for use on doors and windows.



are used, the alarm can be operated directly from the house lines through a step-down transformer. In this case, however, there is the disadvantage that, if the house current is cut off, the alarm no longer gives protection.

The heart of the system is a pair of relays having a low current consumption. Those illustrated have a resistance of 50 ohms, but a somewhat higher resistance, say up to 200 ohms, is desirable for battery operation. If the system is designed for alternating-current operation, a.c. relays drawing about 2 watts at 6 volts will do. Burglar-alarm systems used for protecting stores, factories, etc., carry a surprisingly small current—only a few milliamperes. Relay No. 1, in the wiring diagram, is either a single-pole, double throw type wired so the contacts open when the coil is energized, or a single-pole, single-throw type altered to make the contacts work the same way. Relay No. 2 is a single-pole, single-throw type with contacts normally open (closing when the coil is energized)



NOTE: *RELAY NO.1 POINTS ARE OPENED WHEN COIL IS ENERGIZED. RELAY NO.2 POINTS ARE CLOSED WHEN COIL IS ENERGIZED*

Three toggle switches are used to control the alarm system. Switch No. 1 turns on and off the current from the supply source. Nos. 2 and 3 short out the branch alarm circuits. The alarm shown has two such circuits, one protecting a residence and the other a detached garage. By means of the two shorting switches, either circuit can be cut out. Thus the garage may be protected while the residence doors and windows are free to be opened without ringing the alarm; and vice versa A fourth switch, though not always essential, was found desirable. That shown is a push-button type that is normally closed, the circuit breaking when the button is pressed. However, a small toggle or push- or turn-button canopy switch will do just as well. This is the reason for it. Sometimes relay No. 2 will close before No. 1 when the alarm is turned on, causing the bell to ring; or when the alarm is set off by interruption of an external circuit, operating the main switch may not stop

Type I contacts are installed above the garage door. Contacts on door are at *right* in the photo.

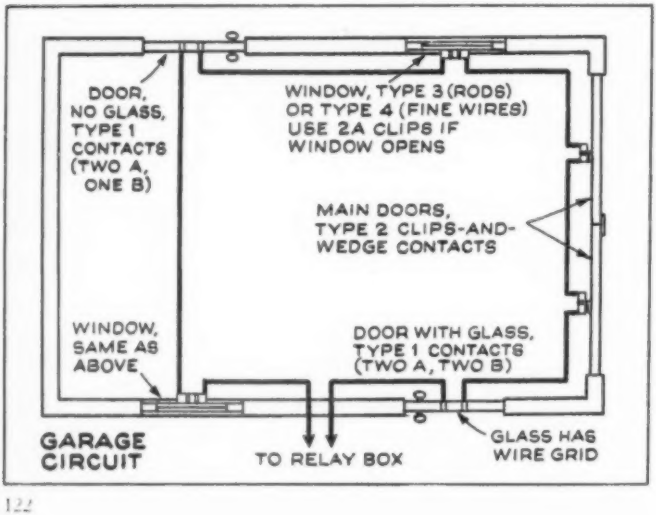
the ringing. With the push-button or similar switch, the current to No. 2 relay coil can be broken momentarily, permitting its points to open. The pilot light indicates whether this switch is on or off.

Two 6-volt radio dial-light or pilot-light lamps, either with screw or bayonet base, burn when the alarm is on. One of these, being behind a red button in the case, acts as a pilot light; the other is simply a resistor. Two lamps connected in series have a much longer life and consume less current than one alone. Although the light output is decreased, it is ample for pilot-light purposes. The bell is any 6-volt type, preferably one having a large gong.

All the parts except the bell are mounted on a $\frac{5}{8}$-inch wooden base and covered with an attractive housing. That shown is a radio chassis base having a crackle finish. It measures 2x5x7 inches. Such boxes are obtainable from radio-supply dealers. With a jeweler's saw an opening was cut for the three toggle switches. Holes were drilled for the push-button switch, pilot-light lens, and mounting screws. The pilot-light lens is a red glass button taken from an automobile license-plate bolt. Grooves were cut in the wooden base for the four pairs of wires leading to bell, battery, and external circuits.

The control unit should be mounted at some convenient spot in the kitchen, upstairs hallway, or wherever else it can be turned on easily when needed. The storage battery and charger may be placed in the basement, a rubber-covered lamp cord being adequate for carrying the current to the control box. As a protective measure, install radio or automobile type fuse blocks in the leads near the battery, and insert cartridge fuses of 1- or 2-ampere capacity, or as small as can be used without blowing when the bell rings.

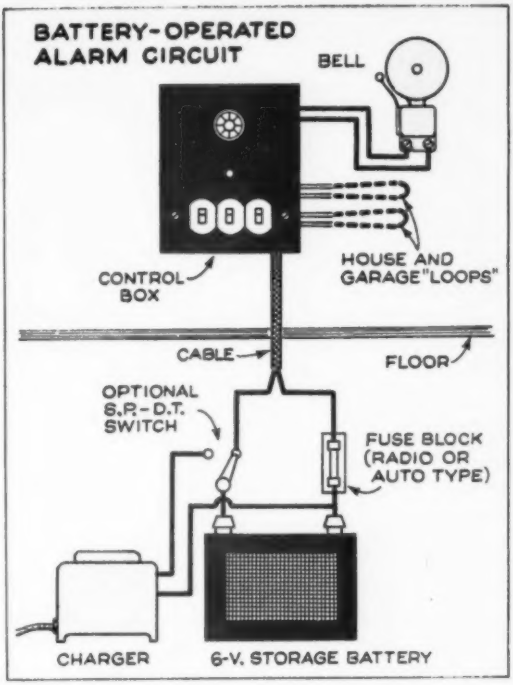
There are numerous ways of arranging the external circuit so it will be broken by the opening of a door, breaking of a window, or similar action. Any kind of insulated wire, including ordinary doorbell or annunciator wire, may be used for this circuit. A door that has no glass may be provided with a simple switching arrangement consisting of a brass or bronze strip nailed along the top edge in such a way that, when the door closes, it touches two spring contact strips (Type 1 in the drawing). These spring strips and the plate may be cut from bronze weather stripping material. The wiping action as the door opens and closes keeps the contacts clean. Construction of the switching device will, of course, have to be suited to the door arrangement. Thus one type of garage door was equipped with a stiff brass blade that

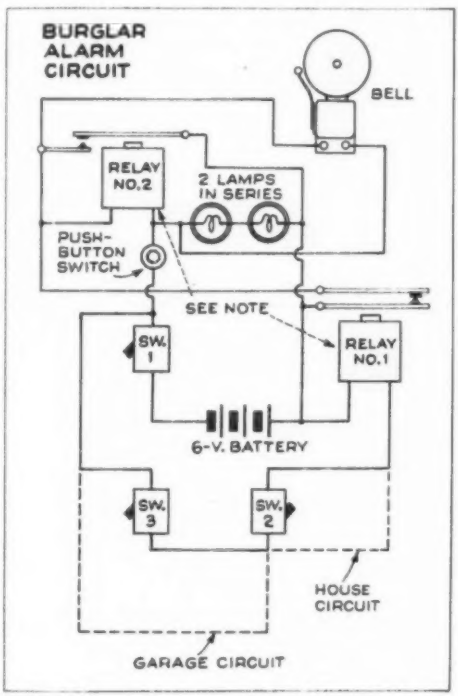

DOOR, NO GLASS, TYPE 1 CONTACTS (TWO A, ONE B)
WINDOW, TYPE 3 (RODS) OR TYPE 4 (FINE WIRES) USE 2A CLIPS IF WINDOW OPENS
MAIN DOORS, TYPE 2 CLIPS-AND-WEDGE CONTACTS
WINDOW, SAME AS ABOVE
DOOR WITH GLASS, TYPE 1 CONTACTS (TWO A, TWO B)
GARAGE CIRCUIT
TO RELAY BOX
GLASS HAS WIRE GRID

wedged itself between two spring-brass contacts resembling those on knife switches. In fact, small single-pole, single-throw knife switches sometimes can be mounted so they open and close with a window or door.

A window may be protected by zigzagging a length of fine copper wire, say No. 40, across it in such a way that the wire will be broken if anyone tries to enter. The wire is connected in series with the alarm circuit. Commercial alarm systems use strips of thin metal foil applied to the window glass near the edges. Usually a thin glue is used to fasten the strips, and waterproof varnish applied over them as a protection. Joints are electrically welded. Basement windows and others where appearance is not important may be protected by one or more light metal rods or bars resting in clips, the arrangement being much like a cartridge fuse and holder. All bars are connected in series. If a bar is forced out of a clip, the circuit is broken.

Special switching arrangements may be hooked into the alarm system. A





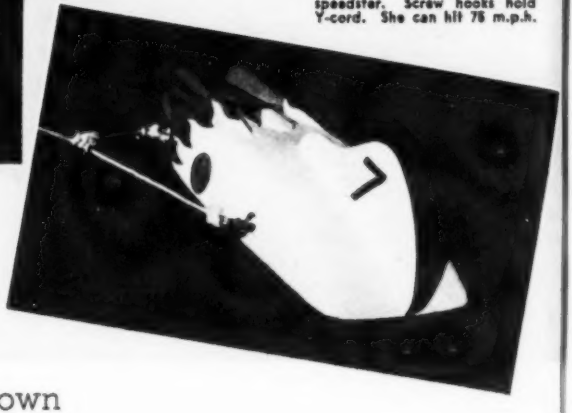
hinged stair step may be equipped with a switch that opens when anyone steps on it. A cabinet containing guns or other valuable articles can be equipped with a door switch and protective bars or other devices across its glass panels. In fact, there is no end to the ways in which the alarm may be connected to protect property. In all cases, try not to leave any loopholes. You should wire all doors and windows into the circuit. Be careful to arrange contacts so they cannot be shorted from the outside. Place the lead wires underground if possible.

In time, various contacts may become dirty or corroded and their resistance will rise so much that the alarm will sound. An occasional cleaning with fine sandpaper is usually the only maintenance work required; and you must keep the battery charged and supplied with water.

Cost of the alarm illustrated, exclusive of the $3.00 secondhand battery, was in the neighborhood of $5.00.

The electrical action of the system is as follows: When switch No. 1 is on, current flows through the external circuits and the coil of relay No. 1, opening the points on the relay. Current also flows through the pilot lights. As long as [*Continued on page* 166]

Three views of motorless super speedster. Screw hooks hold Y-cord. She can hit 75 m.p.h.

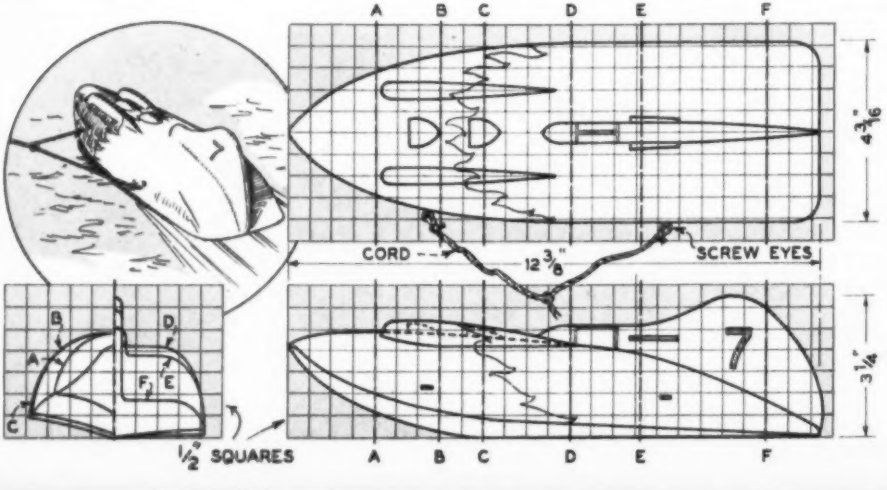


THE *Swingaroo*

by Robert L. Brown

GASOLINE engine powered model racing boats frighten the less experienced model builders by their complex design. The *Swingaroo* is a tow line boat which provides endless pleasure for model boat fans, and is extremely simple to build. The boat is speedily towed around a circular course by means of a pole and a strong cord. Combining a pole and cord in this manner provides a means of towing at speeds which are amazing. On trial runs at Pasadena, California, the boat was clocked at 65 miles per hour. This speed was attained using a pole and cord, the combined length of which was 25 feet. A solid model of this type may be raced in a swimming pool, or on an open body of water. You may send the lively craft around the course from a boat, or while you are wading or swimming.

In cutting a block [*Continued on page* 172]



Priority-Proof Model Plane

Paper and pine are the chief structural materials used in this plane. The general design principle may also be adapted to many other models—try this one to start.

by George Daniels

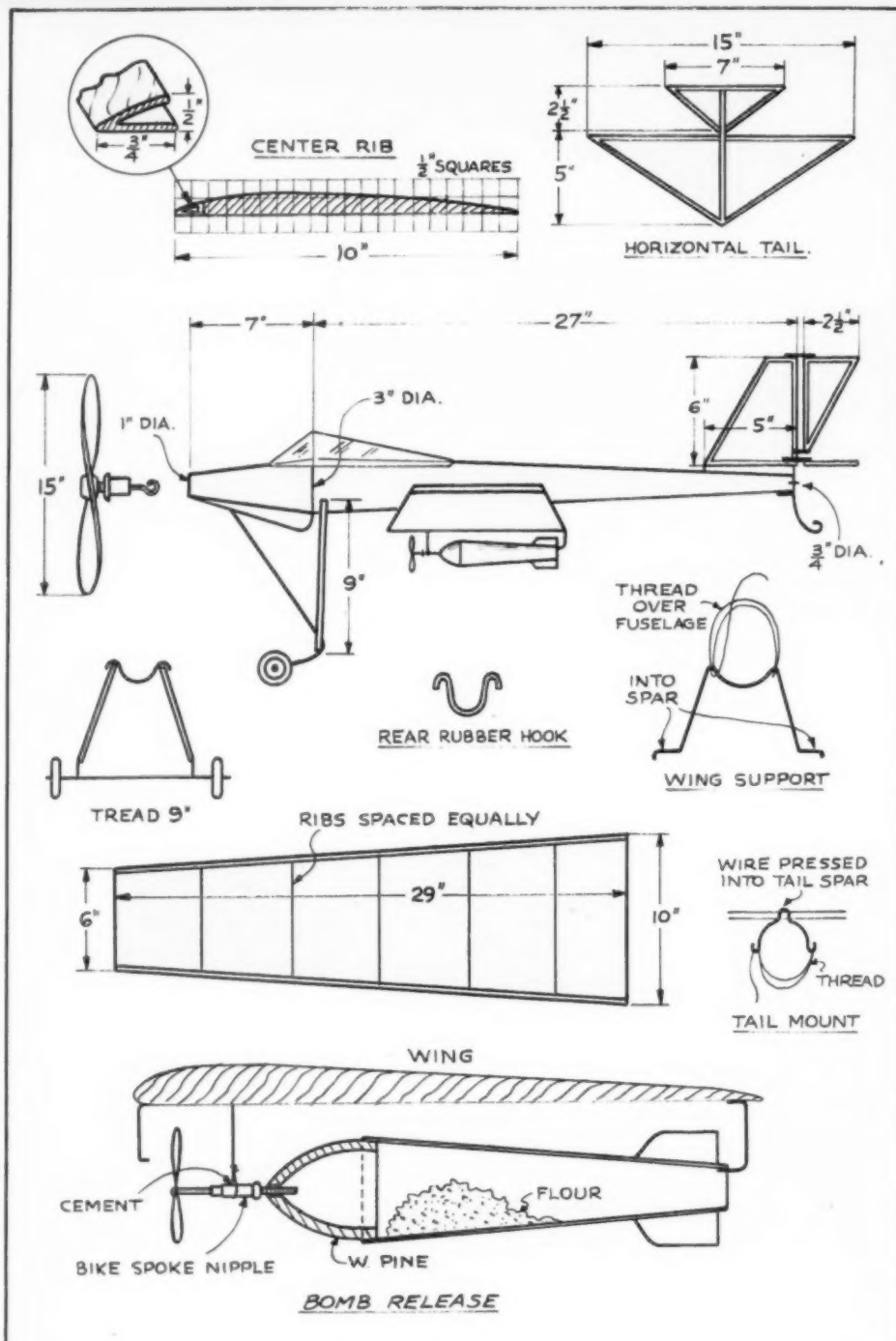
Plenty of soaring ability in that 58-inch wing. Note strips of adhesive on fuselage to hold wing struts in place, and permit easy removal. Struts have been removed from wing in this photo.

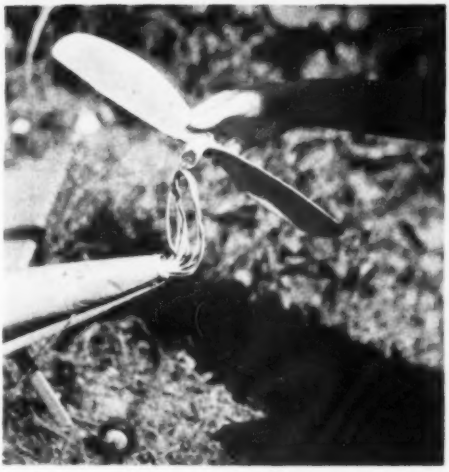
THE type of construction used in this model is practically "priority-proof," as it requires only materials which are at present fairly easy to obtain. Incidentally, bamboo, reed, or even steamed spruce or pine may be substituted for the landing gear struts and wing struts, in the event that you have difficulty obtaining the piano wire. The landing gear axle is made from a bike spoke, as is the principal part of the miniature bomb or "supply" release, and bike spokes are at this writing, at least, not hard to get.

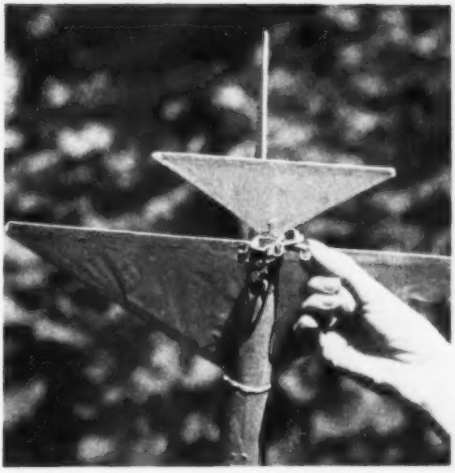
In regard to the rubber motor, model supply stores still have this type of rubber on hand in a great many areas. But this plane may easily be adapted for a model gas engine. The conversion merely amounts to cutting off the forward portion of the front cone, and cementing a bulkhead in the open end with appropriate engine mounts on it.

All surfaces including the tail are built up with white pine framework of the dimensions noted on the drawing. As this wood has much more strength than balsa, it can be used in extremely thin sections and still have ample rigidity. The propeller, even on the rubber powered version, is of white pine also. The blades are sanded thin enough to show "pink" when held up to the light. The original model took off and landed nicely on regular model plane wheels, and also on typewriter erasers. Small strips from an old sardine can were rolled up into bushings to make the type-

"Bomb release" was set for long flight before this was snapped. Model was gliding in for landing when photo was taken. If available, piano wire wing struts often prevent damage to wings when model hits trees, etc., in areas like this, as struts flex and save spars from breaks.


CENTER RIB
1/2" SQUARES
10"
15"
7"
2 1/2"
5"
HORIZONTAL TAIL.
7"
27"
2 1/2"
1" DIA.
3" DIA.
15"
6"
5"
3/4" DIA.
9"
THREAD OVER FUSELAGE
INTO SPAR
WING SUPPORT
REAR RUBBER HOOK
TREAD 9"
RIBS SPACED EQUALLY
6"
29"
10"
WIRE PRESSED INTO TAIL SPAR
THREAD
TAIL MOUNT
WING
CEMENT
FLOUR
BIKE SPOKE NIPPLE
W PINE
BOMB RELEASE





Hook rubber to prop hook and pull it through hollow fuselage with hooked wire. Tapered piece under nose is pine "crash reinforcement." *Right:* Rear rubber hook. It fits in slots in tail.

writer-eraser-wheels fit the bike spoke axle smoothly. The propeller shaft and hook is also made from a bike spoke—the rest of the spoke is the tail rubber hook. Incidentally, if you can't find enough piano wire for the parts shown made of that material, stiff iron wire of similar or slightly heavier gauge will be satisfactory except for the springs. These latter are more or less of a luxurious touch anyway. And get the idea out of your head that iron wire is too heavy. By normal standards this would be a rather heavy plane, but it can climb and soar with the featherweights.

In the actual construction, the first step is the building of the fuselage. This is simple and strong, models of this type having withstood nose-to-tail compression loads as high as 50 pounds. To make it you simply roll two cones of "detail paper." This is a white drawing paper that can be obtained from art or architects' supply stores. The cones have a straight lengthwise seam—not a spiral seam. The overlapped width of the seam should be about ½ an inch.

Regular model airplane cement is used to fasten this seam, but library paste will do if the seam is made 2" wide, and the job must be done properly. Coat both surfaces that will meet, and allow them to dry slightly. Then apply a second coat, and press firmly together; a length of dowel small enough to fit through the small hole of the cone is handy for pressing the seam tight along its entire length. It is advisable to make the cones overlength so that the ends can be trimmed off square.

While the two cones join at their 3-inch diameters, one of them should be made with a short excess length at the big end—extending to a larger diameter—so that the other cone can be fitted into it when they are to be cemented. After the cement dries the protruding rim of the extended cone is trimmed off with a razor.

Before the two cones are joined, however, a piano wire ring is cemented inside the tail cone near the large end. This ring should be about 2½ inches in diameter, and is formed simply by [*Continued on page* 166]

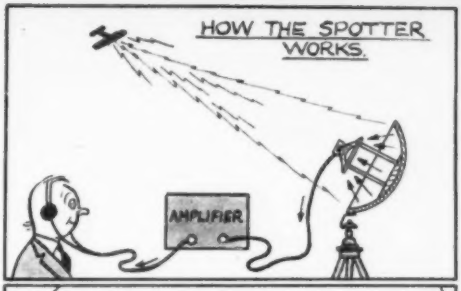
Drawing at *left* shows all details and dimensions of plane. "Bomb release" fits under wing and may be made as desired. Make the nose hole in bomb large enough to blow flour out.

Bill Bildit makes an Aircraft

OH DEAR, I'M SO PROUD THAT YOU'VE GOTTEN TO BE AN AIRRAID WARDEN.
AHEM... EVERY MAN MUST DO HIS DUTY.
1
DIDN'T ANYONE HEAR THAT PLANE DURING THE TEST RAID LAST NIGHT?
NOPE!
WHAT'LL WE DO?
MISSED IT!
CD
CD
2
IF ONE OF YOU HAS A SENSITIVE AMPLIFIER I THINK I CAN SOLVE OUR PROBLEM.
NICK HAS ONE
CD
REPORT
3
THIS WOODEN SALAD BOWL IS JUST THE THING FOR THE PARABOLIC SOUND REFLECTOR.
NOW WHAT'S UP?
LATER
4

Spotter

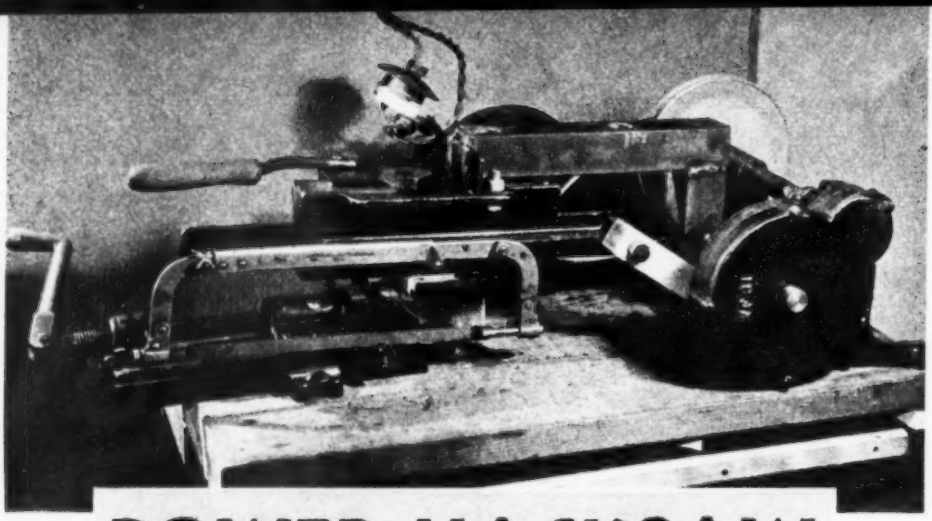
3/8" DOWELS, 7" LONG OUGHT TO SUPPORT THE "MIKE" OK. I'LL GLUE THEM INTO THIS CURVED PIECE AND SCREW THE ASSEMBLY TO THE BOTTOM OF THE BOWL.
5


HOW THE SPOTTER WORKS.
AMPLIFIER

NOW WE SET THE "MIKE" IN THIS CASE A 5" DYNAMIC LOUDSPEAKER, IN PLACE ON THE DOWELS.
6

A METAL ANGLE FASTENED TO THE "SPOTTER" MAKES IT EASY TO ATTACH TO THE TILT-TOP CAMERA TRIPOD.
7

I CAN SEE THE PLANE NOW, BILL, YOU HAD IT RIGHT ON THE BEAM ALL THE TIME.
WHAT WOULD WE DO WITHOUT HIM?
LUNDBERG
8



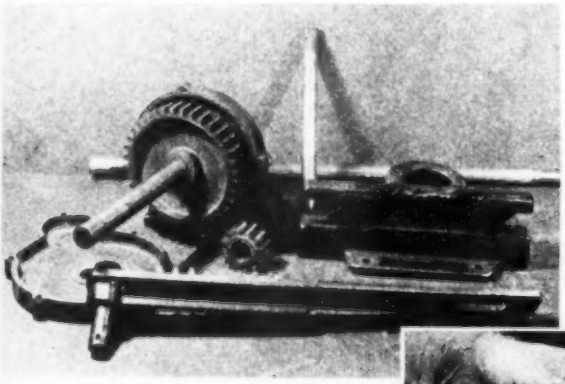
POWER HACKSAW

An old washing machine will provide the parts for this handy tool.

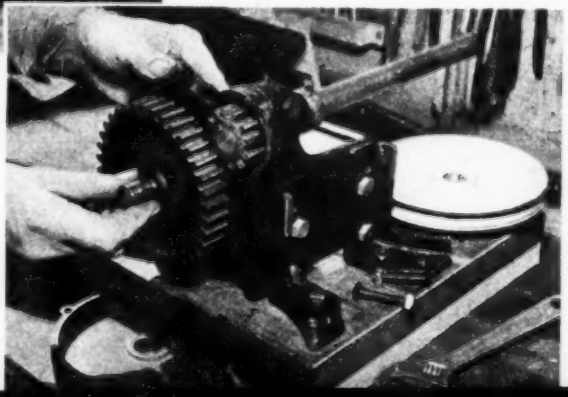
OPERATED by a ¼-horsepower motor of the same type as that found on an old washing machine, this saw, making 125 strokes a minute and using a standard 10", 18-tooth hand hacksaw blade, will cut through a ¾" shaft in about 3 minutes. It was built from available materials for use in a small shop, after a search of two large cities had failed to turn up anything ready-built except some extremely large saws.

Many old washing machines operated with a reciprocating action that is almost identical with that of a power hacksaw. Usually the set-up includes a motor-driven pinion operating against a gear to which a crank is attached. The other end of the crank operates a sliding arm that either rotates or rocks a clothes agitator. The job of converting such a mechanism into a saw involves mostly the rearranging of parts and the attaching of a saw-blade frame to the sliding arm.

In this case, the parts taken from the machine included the following:



In the photo above are shown some of the discarded parts you may use for it. They include: gears, housing, crank and shafts.



Right: Gear assembly is the heart of the saw. Angle pieces used to fasten housing to the base, are cut from sides of old bed spring.

The vertically swinging arm is fastened to its support by a pivot in line with shaft

Motor
Pair of gears having a 3:1 ratio
Housing for them
Crank attached to the larger gear
Shafts ⅜" and ¾" in diameter
Sliding arm or bar and cast iron pieces having two grooves to accommodate the bar
Cast iron plate—bored to fit the ¾" shaft and used, in the saw, to support the outer end of the pinion shaft

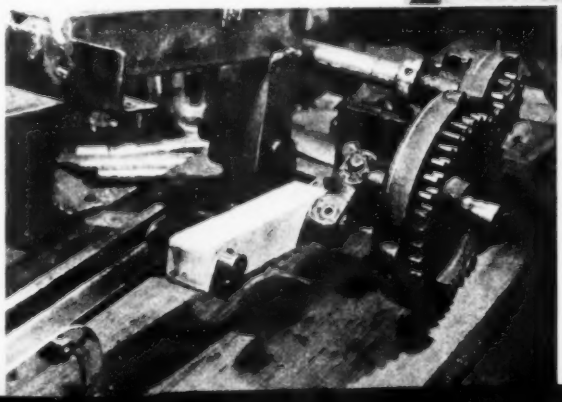
In addition, the items below were obtained:

L-shaped brackets cut from the rails and sides of a discarded bed spring
A length of 1½"x1½" channel iron
A 4" piece of 1"x1" angle iron
A 5" V-belt pulley having a ¾" bore
A 1" pulley with a ½" bore to fit the motor shaft
An old hacksaw frame
Vise for clamping the work
Hardwood base measuring 11½"x23"
Some 1"x1½" wooden strips to serve as cross-pieces under the base to provide bolt-head clearance
Bolts, nuts and washers
Short V-belt

Construction of the saw is shown in the illustrations. The gear assembly was mounted, by means of angle brackets, near one end of the base and the pinion-gear shaft cut to a length of 11". Note that this shaft is supported near its outer or pulley end by the cast-iron plate previously mentioned. The plate was bolted to an angle piece for attachment to the base.

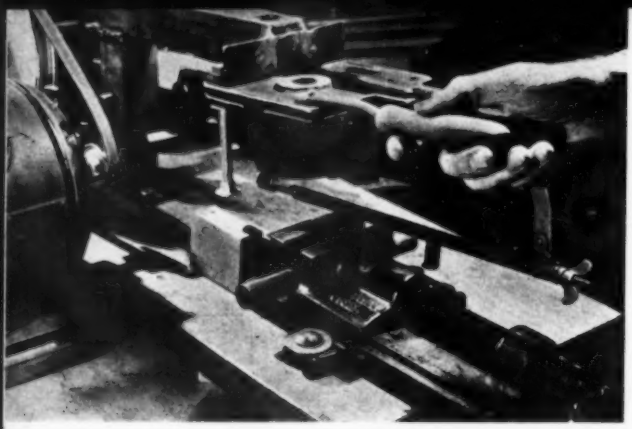
The crank attached to the shaft of the larger gear had a throw of 3", which was about right for the saw. This crank was connected to the reciprocating bar on which the saw frame was bolted. Because no suitable piece of steel was at hand, the connecting arm between bar and crank was made of 1"x1" maple, and was found to be quite satisfactory. Holes in this bar were placed 4" apart, and the wood around them was oil-soaked to reduce friction and wear.

The cast-iron arrangement containing the grooves in which the reciprocating bar slides was an ungainly item, but by sawing off some of the projections, was made reasonably compact. Its weight of several pounds was utilized for holding the saw blade against the work. This was accomplished by bolting it to the end of a swinging arm made from a 9½" portion of the channel strip. A shorter length of the same channel strip was welded at right angles to the other end of the arm, drilled for a ½" pin, and mounted on an upright made of 1"x1" steel. A foot made from angle iron was welded to this upright. (Tests showed that two such



The photo above shows ordinary hacksaw frame mounted to the sliding arm. Adjustable type is best. Make it square with base.

At *left* is a closeup view of the connecting rod. It transmits power from crank to the arm. Steel one is best but wood will do.



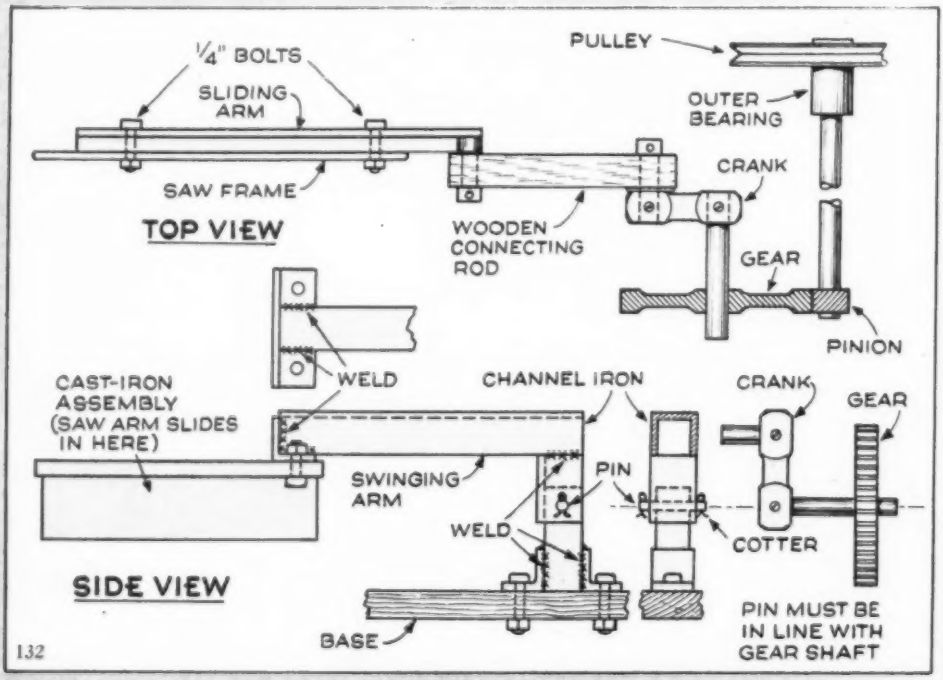
At *left* can be seen: handle for the swinging arm, vise, mount and bolt to limit saw drop

feet, opposite each other, would give greater rigidity; see drawing.) It is important that this upright be placed so that the pin around which the arm pivots is in line with the center of the gear to which the crank is attached. This permits the saw arm to be swung up and down through a considerable arc without binding.

The channel strip was attached to the cast-iron assembly by means of a piece of angle iron welded to its free end and drilled for bolts passing through holes already in the cast-iron unit. One of the bolts is 5" long and its lower end (head) strikes a block the height of which is such that the blade will drop no lower than necessary to pass through the work. A convenient handle was attached as shown for lifting the swinging arm. Of course, you will have to alter this design to fit the materials you have. The height of the swinging arm, sliding-bar guide, etc., should be so chosen that when the blade is at the bottom of its cut, it will be parallel to the base board.

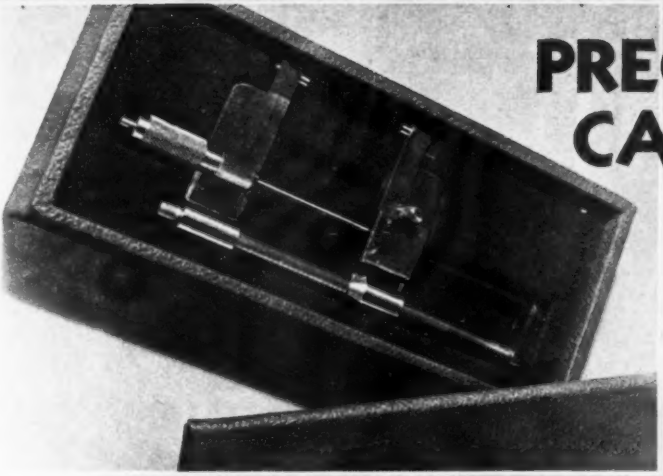
The blade frame is the adjustable kind, but was mounted rigidly so only 10" blades will be accommodated. It was fastened to the sliding arm by two ¼" bolts. If an extra hole is drilled for the front bolt, the frame may be altered to accommodate a blade of different length; some frame designs may permit the use of several such holes. In mounting the frame, take pains [*Continued on page* 172]

Below: Crank and sliding-arm assembly and swing arrangement.



PRECISION CALIPER

by
W. T. Warde

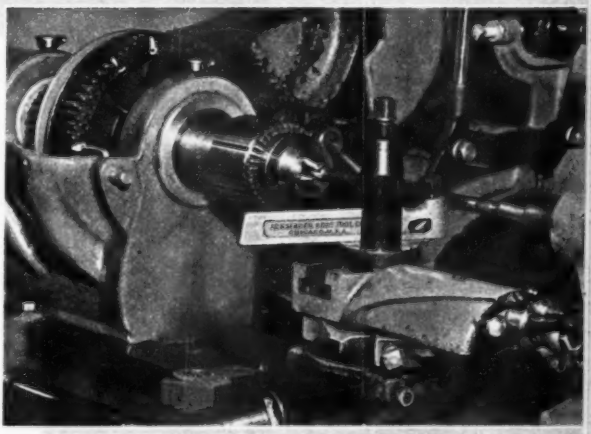


This caliper illustrated at *left* is extremely accurate and will try all your skill as a fine machinist.

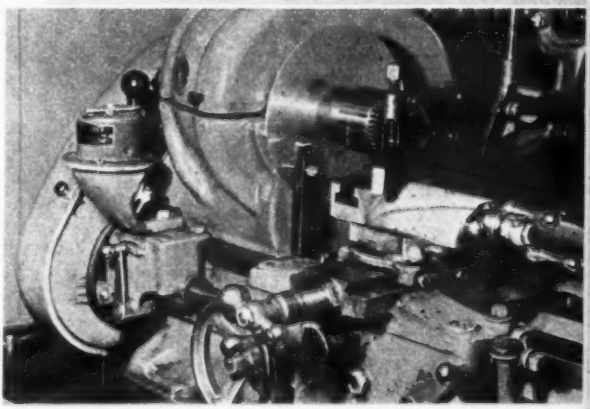
WITH the buying of calipers out of the question for some time to come, those who need them can do only one of three things: make one, borrow one, or do without. If you want to test your ability to do precision work and at the same time acquire a workable, accurate caliper capable of measuring from zero to four inches, both inside and outside, then try your skill on this one. Actually, such an instrument can never be as accurate as one which does not extend over more than one inch of measurement and is capable of reading to within one ten-thousandth, a degree of accuracy rarely needed by the hobbyist. This precision caliper, however, will read within one-thousandth (even less, if carefully handled) which is close reading for the average machinist.

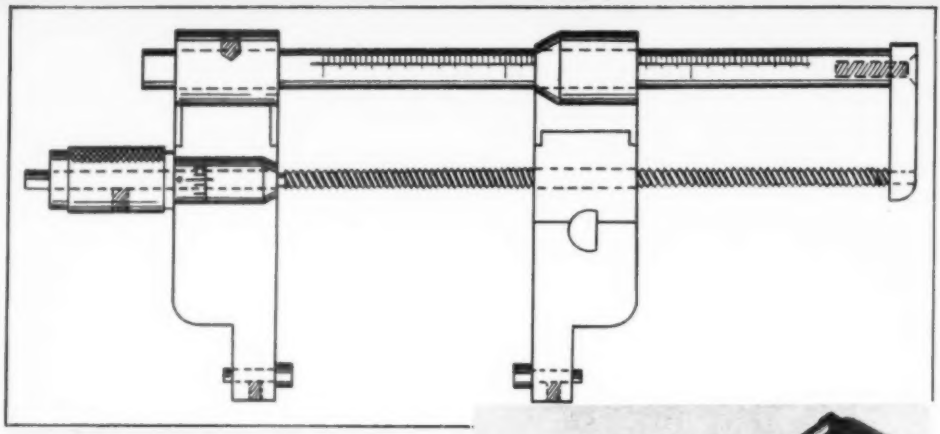
The first job is the turning, drilling and milling of the two main barrels. These operations should be done with the barrel as one piece, and it should not be parted until all operations are completed.

Next, the large shaft should be turned, and this requires an exceptionally accurate slide fit. The shaft should be turned and polished to a tight fit and then the hole in the barrel lapped until the correct size is obtained.

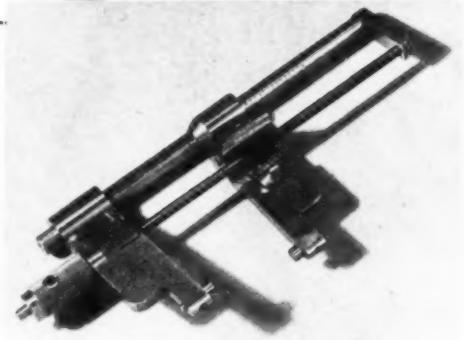


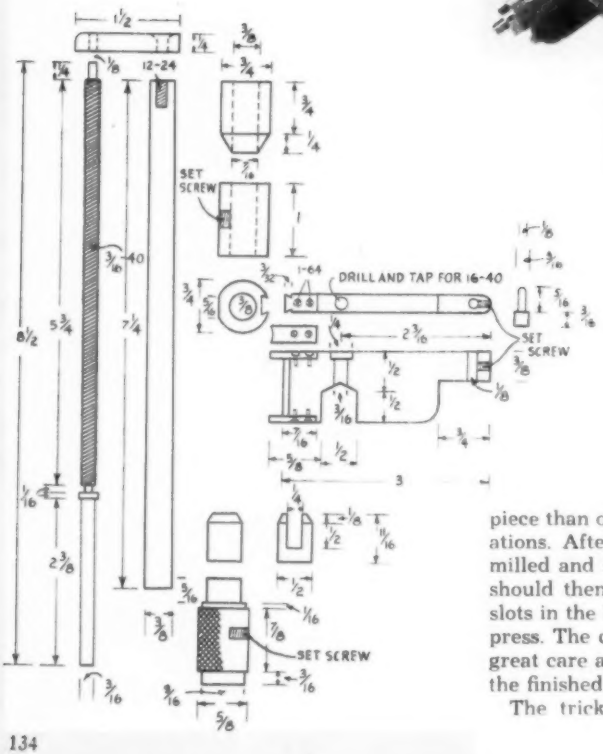
Above and *below* are photographs of the caliper barrel and shaft being calibrated. Check against 2-inch micrometer.





Above is a drawing showing the arrangement of the parts. *Right* is photo of the finished instrument, showing the half-nut open. Thin felt is used as a wiper for lead screw.

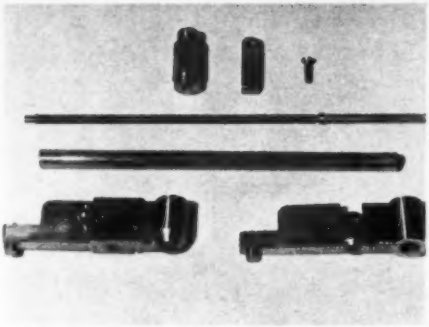




Next comes the lead screw and fittings, the two anvils, and the lock nut on the upper jaw. The lock nut serves a dual purpose in holding the half-nut closed with a running pressure, and, when tightened, by locking the half-nut on the lead screw when the reading has been obtained.

With these finished, the next job is the making of the two jaws and the milling of the dovetail slot to fit into the barrel. This dovetail should be milled before the jaws are cut apart as it makes for greater accuracy to do this on one long piece than on two smaller pieces in two operations. After separation, the jaws should be milled and filed to shape and polished. They should then be force-fitted into the dovetail slots in the barrels, using the vise as an arbor press. The cutting of these dovetails calls for great care as no looseness can be tolerated in the finished job.

The tricky part of this project is in the

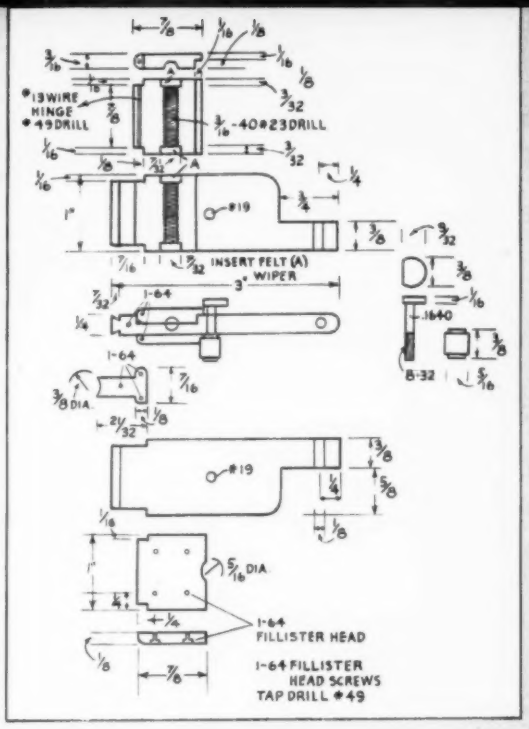


Above are shown parts of the caliper before assembling.

making of the half-nut and the exact drilling for the lead-screw shaft. The half-nut allows the operator to shift from a high to a low reading without the delay of working on the lead screw. However, when it is changed in this way, the reading on the shaft must be checked against that on the thimble to make sure that the zero readings coincide.

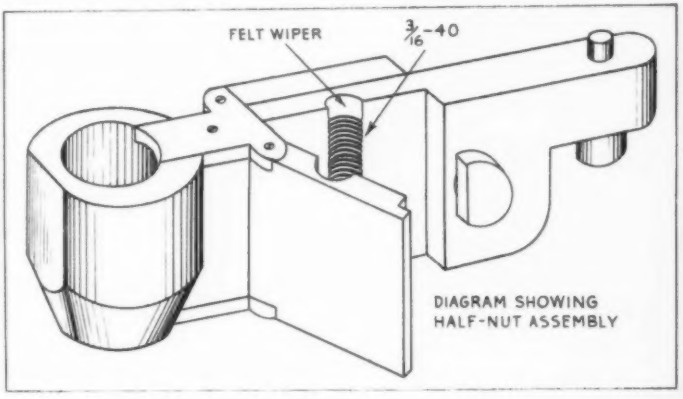
The entire half-nut assembly should be completed on the upper jaw before drilling and tapping. This drilling and tapping should, of course, be done with the work held in the independent chuck so that the same setting of the chuck can then be used in the drilling of the lower jaw, thus ensuring perfect alignment for the lead screw.

After the upper jaw has been tapped, drill out the top and bottom of the half-nut thread as shown in the diagram and insert a thin piece of felt in both sides of the half-nut, at top and bottom, as a wiper for the lead screw. This can be held in place with a spot of acetate cement or cascamite.

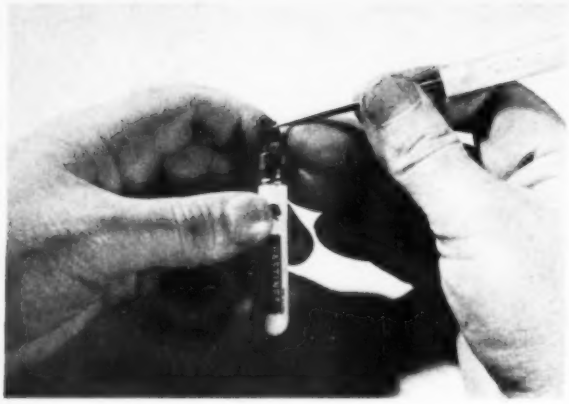


The lead screw and anvils should be made of tool steel and tempered before assembling, all other pieces being of cold rolled or mild steel.

When the entire caliper has been assembled, the jaws should be screwed down until the anvils are just touching and a mark made on the shaft at the edge of the upper barrel. This will constitute your zero reading from which you can then calibrate the entire shaft.



The half-nut assembly is the most difficult part of this instrument to make. Complete on upper jaw before drilling and tapping. Use the same setting for lower jaw.



Keeping Cigarette Lighter In Good Condition

THE flint wheel of a cigarette lighter does not quickly wear out, but after some use the gullets between the teeth may become filled with gum and dirt so that it does not strike a spark. Merely cleaning out the gullets with a sharp point, such as that of a needle or pin, will restore the lighter to a condition equal to new. Clean the wheel shaft, too, while you are at it, so the wheel will turn more easily.

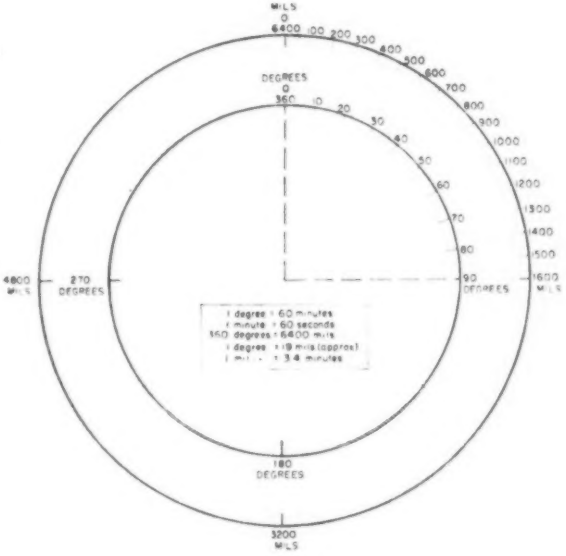
Mils vs. Degrees

THOUSANDS of young men who have entered the Army in recent months have discovered what is to them a new unit of measurement, the "mil." This is a unit of angular measure, used instead of "degrees" on many artillery weapons and associated fire-control equipment. It bears no relation to the "circular mil" commonly used to indicate the cross section area of wire, or to the word "mil" sometimes used in conversation among mechanics to mean one-thousandth part of an inch.

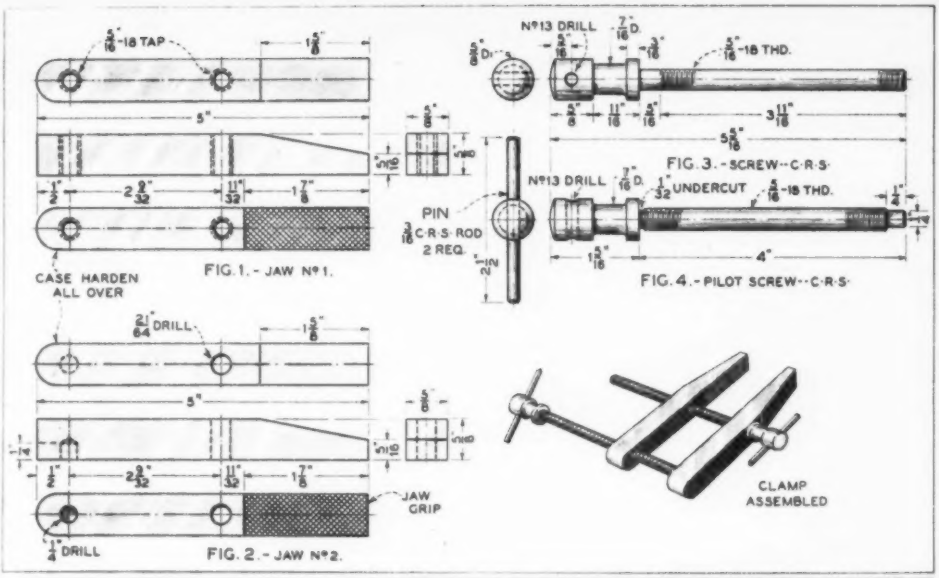
It must be understood immediately that the 360 degrees we usually associate with a circle are entirely arbitrary units. There could be 300 or 500 "degrees," or any number, depending on how finely we care to subdivide the circle into equal parts. Furthermore, there is no particular sense to calling fractions of a degree "minutes" and "seconds." Some early mathematician must have associated angular measure with the hands of a clock, which also go around in circles, and the habit has stuck.

In the "mil" system, the circumference of a circle is divided into 6,400 equal parts by lines drawn from the center to the circumference. The angle thus formed between any two adjacent lines is one mil. A semi-circle then contains 3,200 mils, a quarter of a circle (a "right angle") contains 1,600 mils, etc. A small angle that is expressed awkwardly as 5 degrees, 36 minutes in the degree system is merely 100 mils in the mil system.

The relationship between degrees and mils is shown in quickly understandable form in the sketch. This chart is worth mounting on



cardboard, to be kept with other measuring or drawing instruments in the shop. Incidentally, the dials of numerous compasses are marked in just this manner, much to the confusion of many sportsmen, hunters, Boy Scouts, guides, etc., who cannot find any explanation of the outer numbers in any ordinary literature. [*Continued on page 174*]



MACHINIST'S LEVEL CLAMP

IN THESE days of priorities and shortages the machinist or craftsman will certainly find this level clamp worth considering. It can be made of old pieces of scrap iron and steel which you must have lying around the shop or garage. It is extremely simple and will be a worth-while addition to your tool kit. You might want two or three of them. They come in handy for holding small pieces for drilling, etc.

The clamp consists of four pieces of 5/8-inch square stock—5 inches long, two pieces of 5/8-inch round stock—5 5/16 inches long, and two pieces of 3/16-inch round stock—2½ inches long. With the aid of a bench lathe and a drill press you can turn it out in a very short time.

The jaws are made from the 5/8-inch square stock. Carefully lay out the dimensions as given in the diagram. In the first jaw drill two holes with a ¼-inch or F drill as indicated and tap for a 5/16-18 N. C. thread. File the end to a taper of the required size. On the second jaw, taper the end and drill a 21/64-inch hole as shown. At the other end on the bottom side of the jaw drill a ¼-inch hole ¼ inch deep to take the end of the pilot screw. Put the jaw grips on both jaws with a knife-edge file and then caseharden.

For the main and pilot screws use the two pieces of 5/8-inch round stock. Place each piece in the lathe and face off the ends. Center the drill, place each piece on the centers and turn down to the correct size as indicated in Figures 3 and 4 in the drawing. Next thread the small ends of the screw shafts with a 5/16-18 die and drill a hole in the head of each with a No. 13 drill. The end of the pilot screw is turned down to a ¼-inch diameter for a distance of ¼ inch. This fits in the hole previously drilled in the bottom side of the second jaw. A 1/32-inch undercut is made directly below the pilot screw head.

The two pins are made from the pieces of 3/16-inch stock. The ends may be rounded off with a file or chamfered. When complete they are pressed into the heads of the screws.

C.R.S. in the diagram indicates that the parts are to be made of cold rolled steel.

MODEL FANS!

So many of you wrote in and told us that you liked the Model K Ford car in the November MI that we're going to bring you a whole series of interesting car scale models. Your old friend Hi Sibley is working on them, so you know they'll be good. Watch for the first one in the April issue of MECHANIX ILLUSTRATED.

THE SCHOOL SHOP

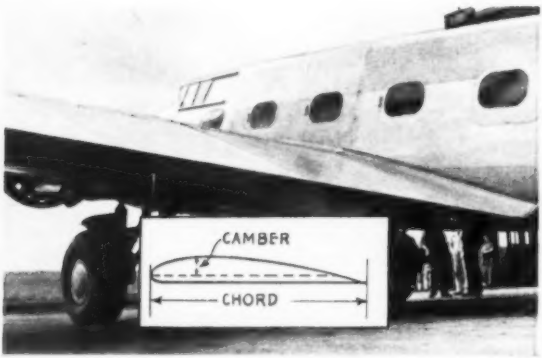
Conducted by Gilbert Paust

Ground Instructor and Lieutenant, Civil Air Patrol

Lesson 2: The Plane Of Today

THE modern plane represents one of the greatest mechanical achievements the world has ever seen. To get an idea of the purpose of its design and the function of its various features without going too deeply into the study of aerodynamics, let's look it over briefly and get acquainted with some of the why's and wherefore's.

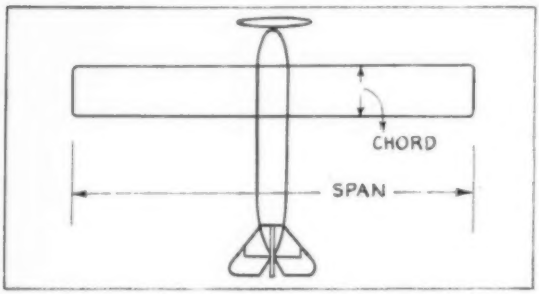
The wings are the surfaces which hold the plane in flight. They are called *airfoils.* An airfoil is, by definition, any surface designed to obtain a reaction from the air through which it passes. In this case the reaction is a force called *lift* which is directed upward against the pull of gravity upon the plane. A wing is not flat but curved. This curvature is called *camber.* The length of the wing is the *span* and the width is the *chord.* The span divided by the chord is the *aspect ratio.* The lift of different airfoils depends upon their camber, aspect ratio and wing area. Heavy transport planes, which are relatively slow, require thick long wings—those having high camber and a large aspect ratio, as in the Douglas type. High speed racing planes and pursuit ships, however, have thin, stubby wings. Gliders must be constructed so that they can respond to the slightest air current upon which they are dependent for lift and are therefore given wings of a very high aspect ratio.



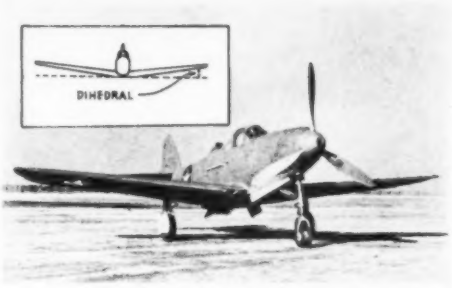
The photo above is that of a Boeing Transport plane with an all-metal cantilever type wing. Notice the thick airfoil. Speed is only 171 m.p.h.

When wings slope upward toward the tips, they are said to have *dihedral;* when they slope backward, they have *sweepback.* These terms are illustrated in the drawings and photographs. They are for purposes of stability and will be considered in a later lesson.

Ailerons are surfaces set in the trailing edges of the wings and are



Left: Drawing showing span and chord. Photo *below* shows the large wing span of Flying Fortress.



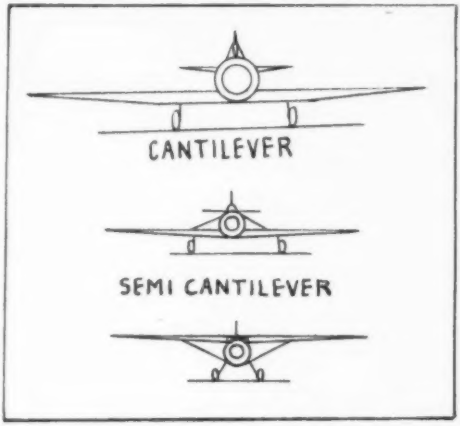
In the photo *above*, dihedral of the Bell Airacobra is plainly visible. Notice the short span and relatively thin camber.

for lateral control in banking, etc. They are manipulated by the pilot from the cockpit or cabin. There is one in each wing and they work in opposition to each other—when one is lowered, the other is raised.

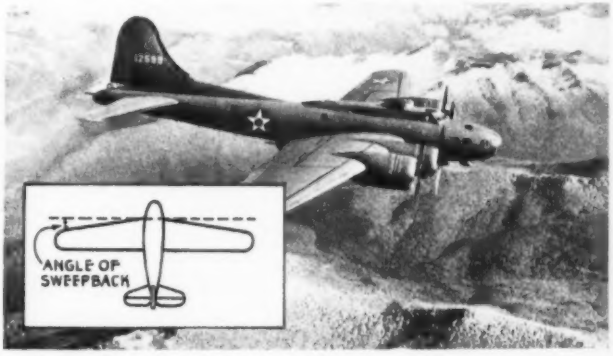
Flaps are similar to ailerons and are also placed in the trailing edges of the wings. They are situated closer to the fuselage, however. Their purpose is twofold: to act as brakes in reducing the landing speed of a plane, enabling it to glide to the field at a steeper angle, and also to supply additional lift to the wings on takeoff by increasing the wing camber. They are also controlled from the cockpit. When retracted, they fit flush with the wings. When in use, they are lowered from the wings to various angles. Three types are shown in the illustration. The Fowler flap is used on the Douglas DC-3 and the P-40 uses a split flap.

Slots or *eyebrows* are passages constructed in the wing directly behind and parallel to the leading edge. They are generally found in planes which are termed "spinproof." They permit the plane to climb at angles steeper than normal and also add to its stability. The Stinson 105 has them.

Above is photo of glider wing showing the high aspect ratio necessary for flight. In the drawing *below* are shown cantilever type wings: the full low-wing and semi high- and low-wing.

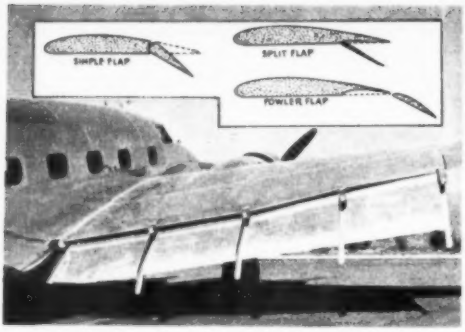


At the *right* is the deadly Flying Fortress, the Boeing B-17E. The photo clearly shows the sweepback incorporated in the design of the wings for purposes of stability. Insert diagram explains exactly how angle is measured.



This is the second of a series of lessons on Aviation to appear in MI for the benefit of preflight students and others interested in the subject. Lesson I in the last issue was on the History of Aviation. Save all of them and at the end of the year you will have a complete text to which you can refer when you meet a question that "stumps" you.

What do you think of these lessons? Don't hesitate to send us any criticism or comment you may have in regard to them. As a matter of fact, we'd appreciate hearing from you. Address your mail to: Aviation Editor, Mechanix Illustrated, 1501 Broadway, New York City.

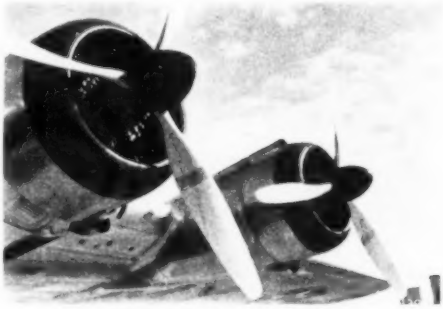


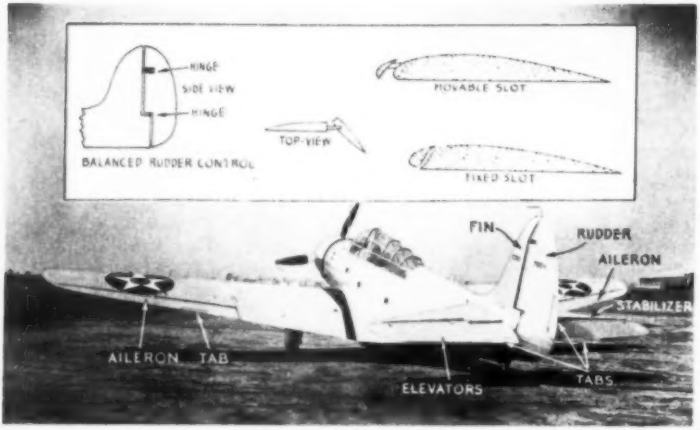
This photo of a Douglas transport shows the Fowler flap when lowered. Flap acts as brake and also adds lift in a takeoff.

The wings may be joined to the fuselage near the top, as in the case of the Aeronca, Piper Cub, Taylorcraft, or the bomber we hear so much about these days—the Martin B-26. Such planes are called *high-wing*. When they meet the fuselage more to the center, as in the case of the Grumman "Avenger," the ship is termed *mid-wing*. Ships with the wings attached to the bottom of the fuselage are *low-wing*, such as the Ercoupe or Bell Airacobra. Wings without external struts and wires bracing them to the fuselage like the Ercoupe, Culver Cadet and the modern pursuits and bombers, are the *cantilever* type. They have an advantage over the others because a great deal of drag due to external bracing is eliminated. When external struts or wires are used, they are streamlined. Such members are known as *fairing*. They produce only 1/15 of the drag of a round member.

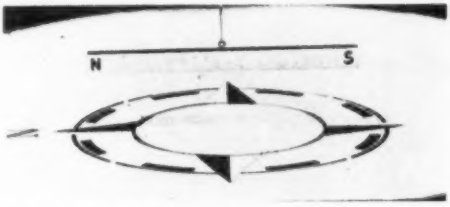
The tail assembly, or *empennage*, consists of the vertical fin, rudder, horizontal stabilizers and elevators. The fin is stationary and assists in keeping the plane on a direct course. The rudder, controlled by the pilot, changes the heading of the plane, and the stabilizers aid in maintaining a level flight position. The elevators, when lowered, increase the camber and therefore the lift of the stabilizers and cause the tail to rise and the nose to drop to gliding position. When raised, they decrease the camber—thereby reducing tail lift and raising the nose to a climbing position.

Stabilizers are set in a fixed position in most planes but in some, like the Piper Cub, they can be raised or lowered slightly by the pilot while in flight. This adjustment is used to aid the pilot in obtaining the correct tail lift in takeoff, in establishing a proper gliding angle when making an approach to a landing area, and also in *trimming* a ship for straight-and-level "hands off" flight at cruising speed. With "fixed" stabilizers this is accomplished by means of *tabs* or *Flettners*, placed in the trailing edge of [*Continued on page* 168]



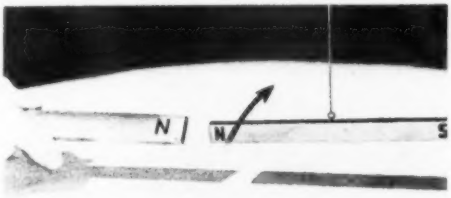


Above: Closeup view of engine nacelles on a new U.S. Army bomber. Notice three-bladed props. Engine ring cowl reduces drag. Control surfaces are indicated in the photo of Navy dive-bomber at *left*. Balanced surface and slots in insert.

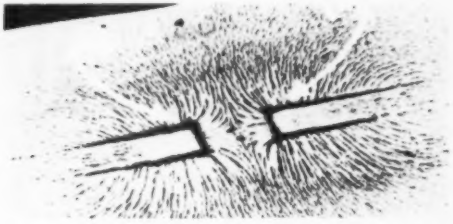


If a bar magnet is suspended by a thread, pole which points to the North is the North Pole. The other end is the South Pole.

Every magnet has two poles. If we place a magnet in a pile of iron filings, we'll find the filings will cling to these poles.



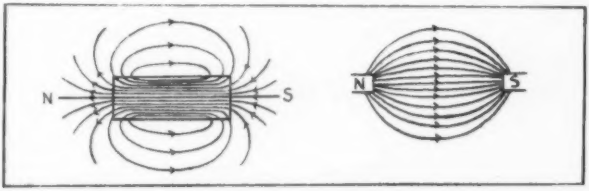
Like magnetic poles repel each other, while unlike magnetic poles attract each other. These are laws of magnetic action.



If like poles are placed together, piece of paper placed on top and filings thrown on it, the lines of force will be seen.

Right: Diagrams showing invisible lines of force about a magnet and also between two like magnetic poles. Filings make them visible.

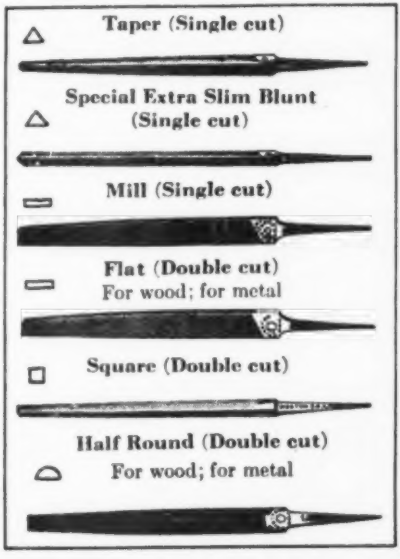
Photos Courtesy Jam Handy Organization



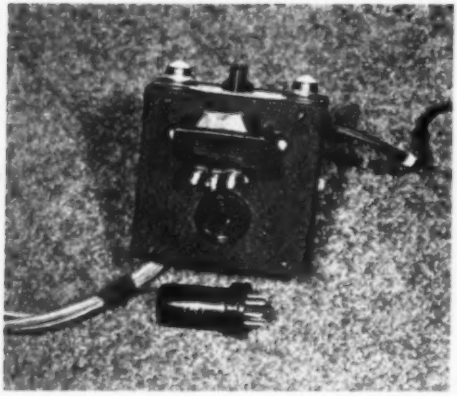
MI SHOP SCRAPBOOK INFORMATION SHEET

No matter how well a workshop may be equipped in every other respect, it cannot be complete without a useful assortment of files. All hobbyists should be familiar with their various types and uses.

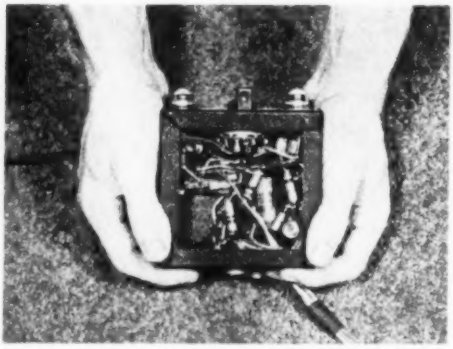
Files are made for both wood and metal working (they're generally called "rasps" for the former), and are typed according to shape, length and cut, or tooth pattern. While there are literally hundreds of shapes and cuts manufactured, the craftsman need only concern himself with those most generally used, such as flat, round, half-round, mill, square and taper. Cuts are referred to as single, double or rasp; and bastard, second and smooth. Single cut files have one unbroken, parallel course of teeth across their surface, at an oblique angle. This cut is used on mill and taper files, for lathe work and tool sharpening. Double cuts have two courses of teeth crossing each other, and are used by machinists. Flat, square, round and half-round are double cut files. Rasp files have the teeth staggered, and are used for rough work by blacksmiths, cabinet makers, etc. The terms "bastard," "second" and "smooth" designate the coarseness of the teeth, bastard being the roughest.



ADAPT YOUR RADIO



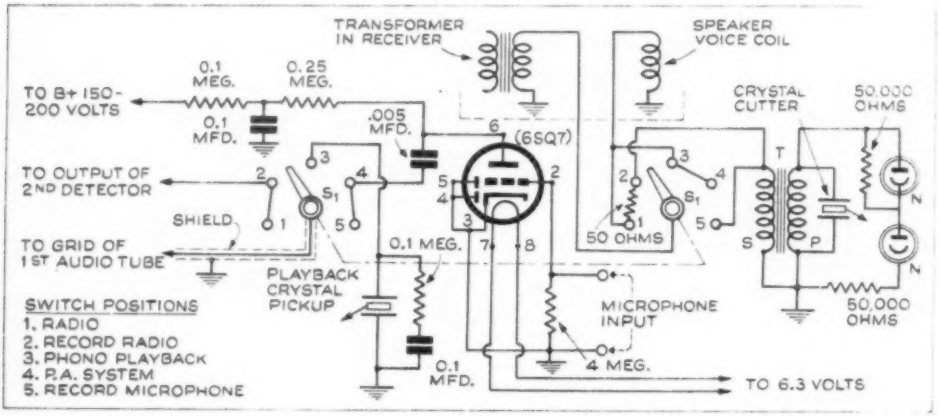
With a soldering-iron, screwdriver, and two hours' time you can connect a recorder-play-back unit to your radio.



The simple, compact unit is shown in the photographs. *Above:* view of the outside, and *right:* looking inside the completed rig. Entire unit and amplifier is built on a 4 x 4 x 2-inch chassis.

WITH this simple unit you can connect a recorder to any radio with only minor changes in the circuit. If you do not already possess a phonograph, one of the new dual phono-recorder units can be connected with equal ease. Turning a knob on the front of the unit gives you a choice of 1) normal radio reception, 2) recording off the air, 3) phonograph playback, 4) use of your radio as a public-address system, or 5) recording through the microphone.

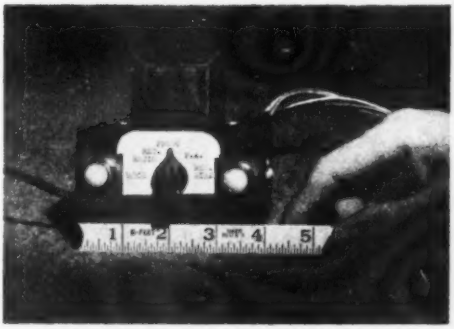
The entire unit including an amplifier for use with the mike is built on a 4"x4"x2" chassis. All wiring is beneath the chassis and all parts except the transformer T and 6SQ7 tube are mounted inside. Voltages are obtained from your set, only 6.3 volts for the tube filament and a B voltage of about 150 volts being required. For the 6.3 volts in an "A.C." receiver, connect across the filament terminals of any tube in the radio that uses this voltage. Any tube whose type number begins with the number six is suitable, such as 6F6, 6K7, 6V6, etc. B+ is obtained from the screen voltage supply of the set and the proper connection can be found by determining which is the screen of any of the tubes and following its wiring until it has gone through a resistor. The side of this resistor *furthest* from the tube is the point at which the B+ lead is connected. The B— lead is connected to the set chassis.



FOR RECORDING

by Bob Stang

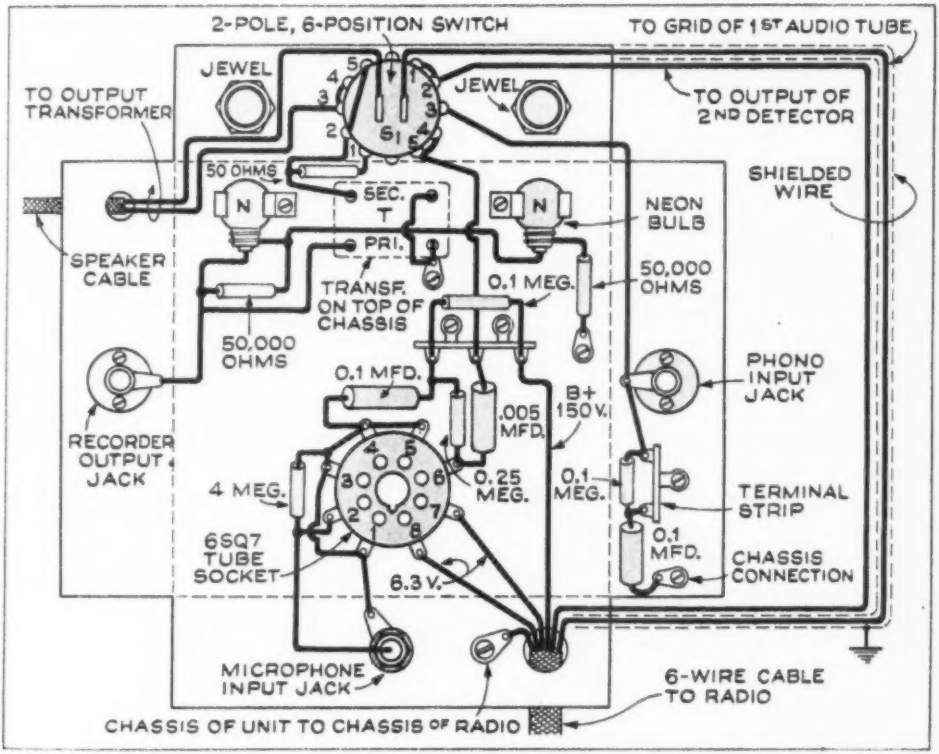
Two cables are brought out from the unit for connection to the radio. One of these is a 6-wire cable which is made up of five insulated wires and one shielded wire. These five insulated wires include the filament and plate leads mentioned previously and also a wire which is connected to the grid of the first audio tube in the set. Disconnect the wire which is already connected to this same grid. This lead is the output of the second detector and is connected to the shielded wire in the cable from the adapter. The connection which you broke is remade in the adapter when you choose [*Continued on page* 176]



One bulb glows at proper volume, other at overload.

PARTS LIST

N—2 General Electric NE-7 neon bulbs
T—output transformer (see text)
S1—2-pole, 6-position switch, Yaxley 3226J
1 chassis, Parmetal MC442
1 octal type, wafer socket
2 RCA-type pin plugs
2 sockets for above
1 Amphenol PCIM mike connector
1 250,000-ohm ½-watt carbon resistor
2 100,000-ohm ½-watt carbon resistors
1 4-megohm ½-watt carbon resistor
1 50-ohm ½-watt carbon resistor
2 50,000-ohm ½-watt carbon resistors
1 .1 mfd. 200-volt paper condenser
1 .1 mfd. 400-volt paper condenser
1 .006 mfd. 400-volt paper condenser
6' of shielded wire, single conductor
5' of 5-wire battery cable
1 6SQ7 tube
2 large bullseyes
1 pointer knob



Continuous, DUAL RECORD

Photos courtesy Radio Wire Television

With this Dual Pickup and Turntable, you can play complete recorded symphonies, without a break, like broadcast stations.

At *left* is a dual record player unit somewhat similar to the one outlined in this article, though mounted in a large cabinet. Note simplicity of top arrangement.

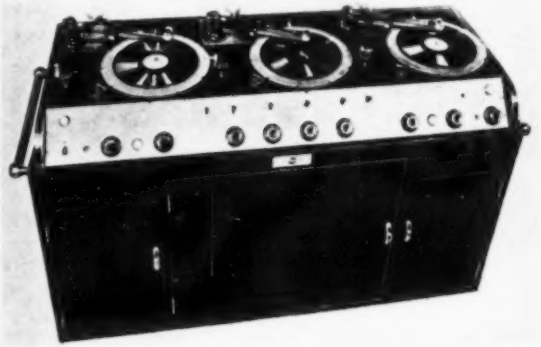
HOW many times have you wished that you could play record album sets the way radio broadcast stations do? You've heard them broadcast the great symphonies from the very same commercial records made for home use, and you may have wondered how they did it, with no apparent pauses between one record and the next. Well, you can do it too, by using the same type of set-up they employ in broadcast stations for this very purpose.

The stunt, of course, is to start the second record just as the first record is completed, and to start the third record just as the second is completed, and so forth. And to *fade* one record into the next so that no break is apparent, just as they fade in and out scenes and music in the movies.

Naturally, if you hope to accomplish this in the home, the first essential is the use of record album sets of the *automatic sequence* type, these being the sets made especially for use on automatic record changers. They are made in two forms; the "DM" pressings for the drop type record changer, and the "AM" pressings for the throw-off type of record changer. In the AM pressings the sequence is such that no two parts that follow each other appear on the same record; and these are the best for our purpose, although more difficult to obtain nowadays. In the DM pressings the same holds true but for one exception, where it is necessary to turn the record. This is on the last record where, in a set of eight parts, for instance, part 5 backs up part 4. Where one may feel it important, a duplicate record can be purchased so that there will be separate records for part 4 and part 5. But you may still be able to get the AM pressings you want on special order, or failing that, you can trade with friends who no longer have use for these sequences.

The second essential is a *dual* record player: that is, two pickups and two phonograph record turntables. While part 1 of an album set is being played on the first turntable, part 2 is placed on the second turntable, all ready to go as soon as part 1 is completed.

Any make of pickup and phonograph motor-turntable can be used, but it is important that both pickups be of the same make and the same type so that the response will be the same from both record players. If the pickups do not have the same electrical characteristics, the music will not sound the same on both record players. It is also important that the phonograph motors have some sort of speed adjustment so that both of them can be set



A triple, professional player of the type used by broadcasting stations which send out programs of continuous recorded music. It is somewhat complex.

PLAYER

by Boyd Peters

to revolve the turntables at the same rate; otherwise the music will be reproduced at one pitch from one of the record players, and at a higher or lower pitch from the other record player.

Now we come to the *fader*, which isn't an essential but is certainly a refinement. It adds a smoothness to the transition from one record to the next that cannot be attained in any other way. There is nothing complicated about it, and once you get the hang of operating it properly and moving it at just the right time, you'll do as well as the broadcast-station technicians.

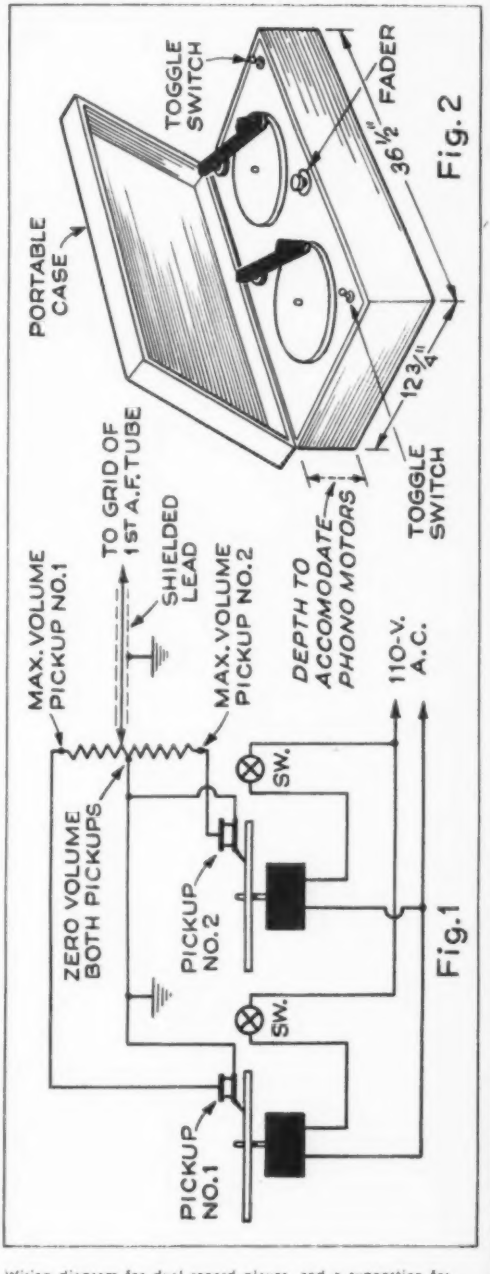
A fader is a dual, two-way volume control having but one contact arm. By grounding the center of the resistance unit and connecting separate phonograph pickups to the free ends, the complete range from zero to maximum volume can be obtained from either pickup with but a single control. Its operation can be appreciated from the diagram of Fig. 1, which shows the complete set of connections for the dual record player.

The contact arm of the fader connects directly to the grid of the first tube in your audio amplifier, just as though a regular volume control were being used. The center tap of the fader resistance unit is grounded, so this is the point of zero volume. Pickup No. 1 connects to the upper terminal of the fader, and pickup No. 2 connects to the lower fader terminal.

Now, if both pickups are playing records and the fader contact arm is at the center or zero setting, no music will be heard from either pickup. On the other hand, if the fader arm is moved along the upper half of the resistance unit, music will be heard via pickup No. 1, the volume depending upon how far along the control is set on the upper resistance unit. There will be no music from pickup No. 2, unless the fader arm is moved past the grounded center tap and on to the lower half of the resistance unit; then, of course, nothing is heard from pickup No. 1.

To get the proper effect in actual operation, the fader arm is moved at a steady rate so as to slowly fade out on one pickup just as the record is ending, and to slowly fade in to the other pickup just as the record is beginning, and building up to the same volume level as used on the first record.

Two phonograph motor toggle switches, SW., are used, as [*Continued on page* 178]



Wiring diagram for dual record player, and a suggestion for mounting in portable case. Fader is seen between turntables.

LENGTHEN YOUR BOAT

You can lengthen your old boat inexpensively and quickly, and you'll gain the comfort a big boat affords.

CERTAIN types of sail and power craft are perfectly adaptable to being lengthened. Another three or four feet in length added on adds not only to the appearance of the craft, but also considerable deck space. In many cases, lengthening solves the problem of building a new and longer boat, thus eliminating the job of starting from the keel up.

The work of lengthening your craft might seem a major operation, but it is a comparatively minor one alongside the task of building an entire hull. It is just the thing to do these days, when a larger boat is needed and when goodly quantities of lumber and fittings are practically unavailable, because of defense priorities.

Craft without an overhang or a fantail—those with blunt sterns from the waterline up—can be lengthened to good advantage. Building a fantail on such types is safe and

Photo at *top* of page shows boat before lengthening. At *left*, completed lengthening job. More deck room, smoother lines result.

Lengthening work is started. Keel is extended first. Cheek pieces are screwed on to it to take the planking later.

Extension progressing. Note that side planks added, run well forward of the old transom.

practicable, and does not appreciably disturb the sail and rig. The increased length aft enables you to set up a permanent backstay, so that you can come about without slackening or hauling-in sidestays.

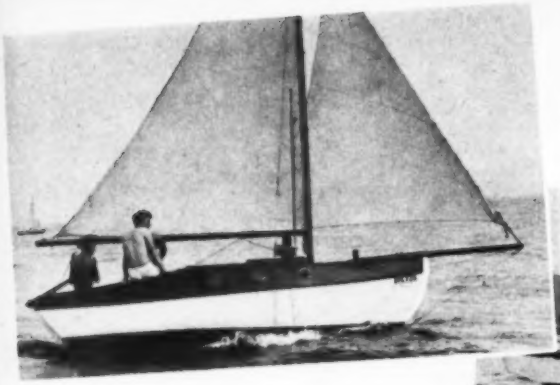
Due to the variety of hull designs which are practical to lengthen, it is impossible to lay down any single set of plans that govern the lengthening of all types. The accompanying plans show a typical craft without a fantail, with an overhang added on. Richard Zimmerman of Milwaukee lengthened his seven-year-old *Buddy*-type auxiliary cruiser to serve the need of a larger boat, and filled the bill perfectly. The length of the addition is 3 feet 8 inches.

Boat owners desiring to lengthen their craft will find the accompanying lines drawings self-sufficient to guide the work. Others preparing to lengthen similar types will have to use these plans merely as essentials and adjust the differences in design to meet individual requirements. Those in the latter category should lay down the hull plans on paper, full size preferred, and draw out the lines aft, extending the deck and bilge chines with a slight upward sweep. Not more than four feet should be added to craft ranging from 18 to 25 feet; and to make the operation worthwhile not less than two feet.

The work of lengthening is preceded by making room to build on the addition. The deck between the cockpit and the transom must come off, and also the deck beams. Then the planking near the stern is *partly* removed. It is best to take off only the shortest planks

New transom in place. This is glued up to size from oak. Pieces are screwed on to it to take the planking later.

Inside view of extension. Side frames are notched for chines and stringers, as shown.



Adding grace to stubby hull lines. These photos show the improvement. Rudder installation details are shown in drawing *below*. Old outboard rudder cannot be used.

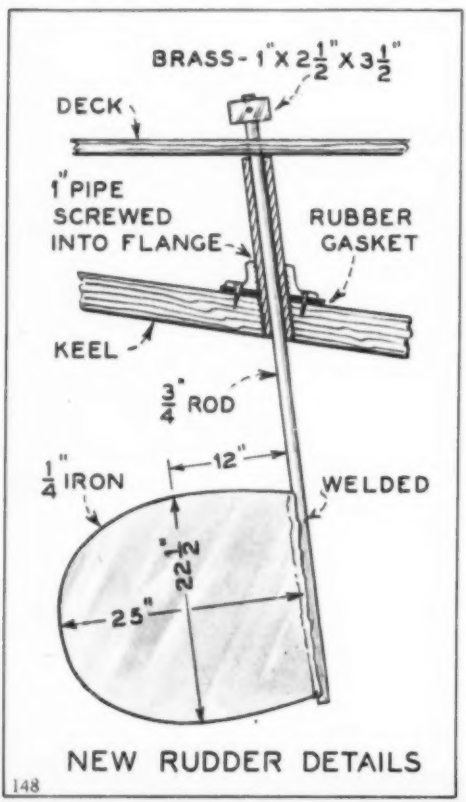
aft. If there are no very short planks, cut alternate planks, on each side, four and five feet from the stern. It is imperative that the remaining planks be widely staggered, or cut to various lengths on each side. Then, after lengthening, the hull structure aft will be as strong and rigid as forward.

As for the existing transom, leave it on until after the addition is complete, to obviate the necessity of building a frame to retain the hull form aft. It is well to state that the old transom may be left on permanently, as part of the hull. This will be discussed later.

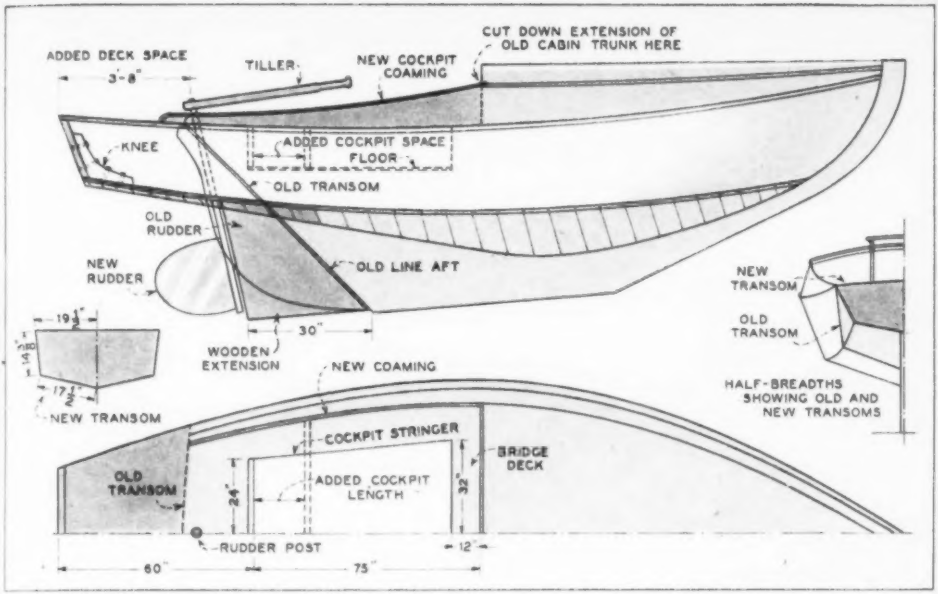
Start the addition by lengthening the keel. With the transom left on, it will be necessary to cut an opening through it for the keel extension, which is set up after removing the existing transom knee by unfastening the bolts. The keel extension is of oak stock, 2″ by 5″ (on this particular job) and its fore end is tapered for a three foot scarf, which is bolted to the existing keel. Use $\frac{3}{8}$″ bolts through the bottom with the heads well countersunk.

The old transom knee may be reshaped for the new transom. It is bolted in place at the proper position. The new transom will, of course, be much smaller than the old, and not requiring much lumber, it should be of good oak stock, 1″ by 6″. Details of the transom given are for rebuilders. Remodelers of other, but similar, types must size the transom according to their preliminary drawings, so that it will fit individual needs. Lay it out full size on paper and transfer the pattern to the oak, glued up to size with casein glue.

With the transom knee bolted securely in position on the keel extension, the new transom is bolted to the transom knee. Next the existing deck and bilge stringers are sawed off about three feet from the old transom. Do not cut these straight across, but on a bias about 1′ long. Then, extension of the stringers or the same stock, $1\frac{1}{8}$″ by $2\frac{3}{4}$″ are cut diagonally to fit the scarf, and riveted and glued on. Then the after ends of the deck and bilge stringers are cut at the proper angle to fit the transom. Rather than fastening the stringers



NEW RUDDER DETAILS



Outline drawing of lengthening job on *Buddy*. Similar procedure can be adapted to boats of other types.

with screws through the transom, a more rigid job is done by fitting 1" oak knees for each stringer. Secure the knees with 2½" No. 8 screws from the outside, through the stringers and transom.

On each side of the extended keel is fastened a clamp or cheek piece of 1" by 3" stock—yellow pine is satisfactory. Evenly spaced, four frames are mortised to fit the deck and bilge stringers flush, and are screwed to the stringers. Before installing the bottom frames, the clamps alongside the keel extension are notched to take the inner ends of the frames flush, too. The outer ends are bolted with ⅜" stove bolts, lock-washered, to the ribs. Inner ends of the bottom frames may either be screwed or nailed into the notches of the keel clamps. Deck beams for the after deck are of 1" by 4" stock and crowned 2". With the top edge flush with the frames, deck beams are stove bolted to the frames.

The added length aft gives the advantage of a longer and roomier cockpit. So it will be necessary to rip up the deck alongside the old cockpit and replace the old cockpit stringers with longer ones to reach the foremost full-length deck beam of the after deck. Refer to the deck plan revision for details. In remodeling, the new plan also calls for cutting down the coaming which is a continuation of the cabin trunk. The short beams are replaced after the new cockpit stringers are installed.

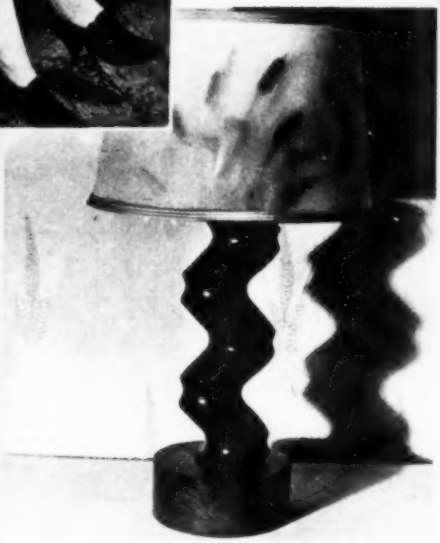
Now for the planking. The sides are planked first. The fore ends of the added planks are of the same size as, and fitted into the recesses of, the staggered-cut existing planks. Make sure that the existing planks are cut half-way between the frames, since butt blocks will be necessary for every side plank put on.

Butt blocks should be at least two inches wider than the regular planking, and fastened inside the hull at the abutting ends, with screws started from the outside. But first, paint the facing of the butt blocks with red lead or creosote.

Saw, then plane the lower edges of the bottom side planks flush with the bilge stringer. The plank edges and bilge stringers are beveled simultaneously to fair with the forthcoming bottom planking. On craft with conventional, fore and aft bottom planking, the planking work is the same as on the sides, with the ends staggered in the proximity of amidships. Bottoms of some boats originally called for athwartship planking, or "washboard" bottoms. For washboard planking, lay strips of flannel soaked in white lead along the keel apron and chines, to save caulking work later. [*Continued on page* 180]

Turned Walnut Lamp
of eccentric design

Wood lathe and saw are all the tools you need to make this unique lamp.



Left: Parts of the lamp ready for assembly. Tenon on bottom of standard is glued into base, which carries lead ballast.

Right: Standard on this lamp was turned from stump walnut. Mahogany or maple are also good woods to use. Suitable shade may be bought cheaply.

Below: How the depression for the light socket is turned. Note that handwheel on tailstock has been removed to permit the free manipulation of chisel.

IF YOU'VE been wanting an attractive table lamp that was different and distinctive in design, that would harmonize with any interior, and that would be easy and inexpensive to make—here's your lamp!

As the photos show, the finished lamp is as beautiful as it is unusual, and definitely does not bear the "Grand Rapids" mass production look. A pair of these lamps on davenport end tables will add 100% to the appearance of almost any living room.

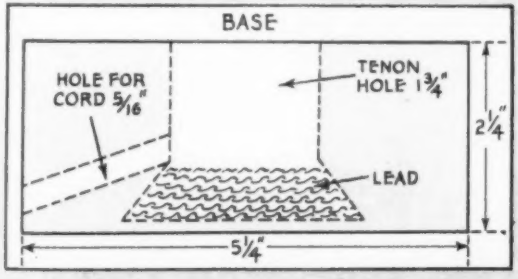
The lamp illustrated was made of walnut, and if you can get some you'll find it easily worked; it will take a fine finish, too. However, any good turning stock may

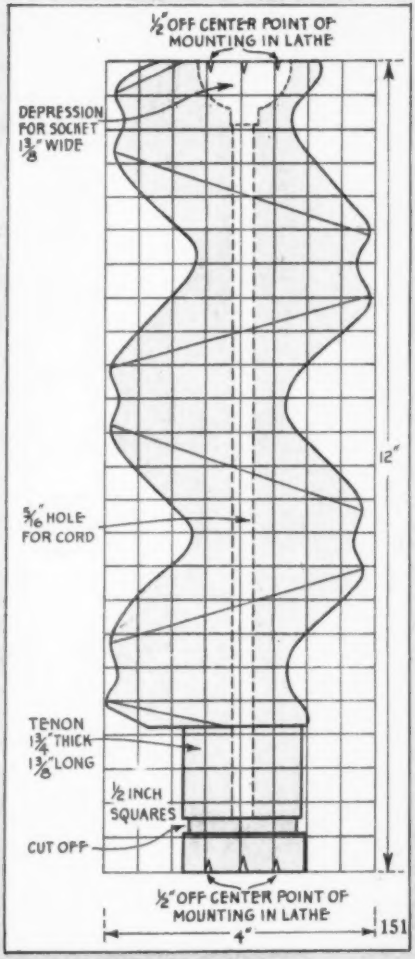
Left: Turning one of the series of off-center cuts. *Above:* Molten lead poured into enlarged base area weights bottom.

be substituted if desired—maple or mahogany, for instance.

Whatever you decide on, make the standard from a piece of wood 4-in. square by 12-in. long. Chuck it in the lathe and turn it first to a diameter of 4-in.—in other words, full round. Next, remount it in the lathe one half inch off center, and take a series of cuts as indicated in the drawings. Remove, remount off center one half inch in *opposite* direction and take similar cuts. Use the parting tool and a sharp, round-ended chisel for this work. When the standard matches your pattern, which we will assume you made from cardboard to start with, sand all surfaces well. Turn a tenon on the bottom end, and a depression in the top to take the lower part of the light socket. This depression is turned as shown in the photo, with the handwheel on the tailstock removed to make room for the chisel handle. Next bore a $\frac{5}{16}$-in. hole lengthwise through the standard for the lamp cord.

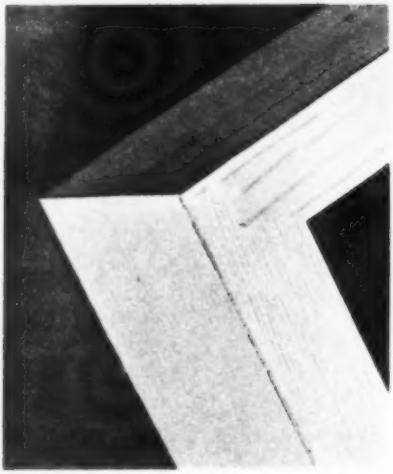
A disk of wood 5½-in. in diameter by 2¼-in. thick forms [*Continued on page* 178]




½" OFF CENTER POINT OF MOUNTING IN LATHE
DEPRESSION FOR SOCKET 1⅜" WIDE
12"
5/16" HOLE FOR CORD
TENON 1¾" THICK 1⅜" LONG
½ INCH SQUARES
CUT OFF
½" OFF CENTER POINT OF MOUNTING IN LATHE
4"

Special Cutter for Corner Joints

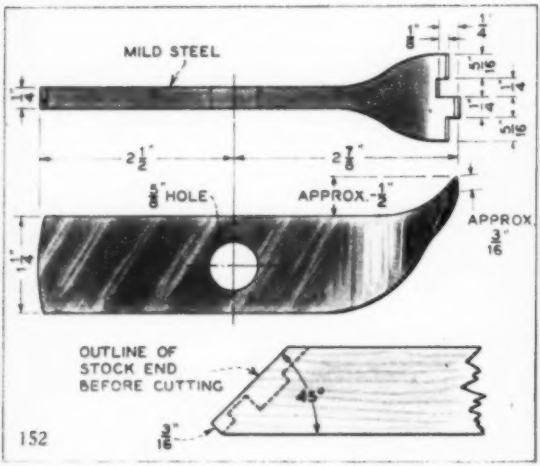
This unique joint shown in the photograph at the *left* is one of unusual strength. It can be fashioned very easily by means of a simple cutter, *below*, which blacksmith can make.



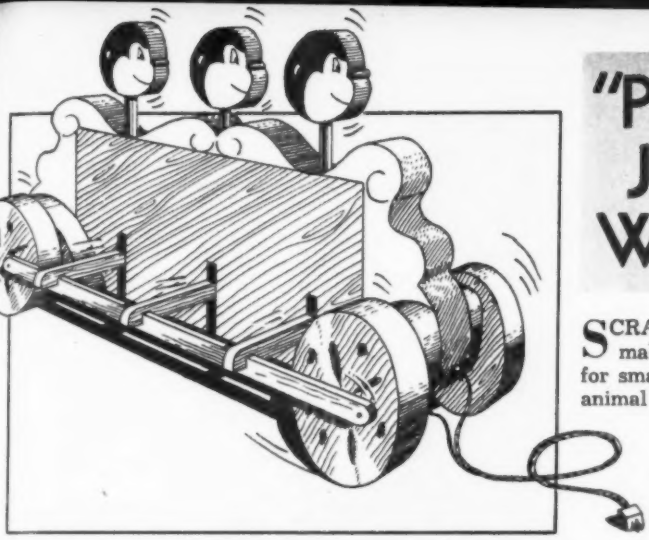
THIS cutter is a very simple instrument and any blacksmith can easily shape it for you from soft steel. It shouldn't cost you very much, either. It will enable you to make this strong and attractive corner joint with a minimum of effort. The same cutter is used in making both halves of the joint by merely moving the fence to the opposite side of the cutter when making the cut for the second half. You will find that your job will be facilitated quite a bit if you clamp the pieces to be worked to a section of beveled stock as shown.

Photo above shows how completed joint will look.

At *lower left* is a drawing showing dimensions of the cutter. *Below:* Holding small work steady with clamp.

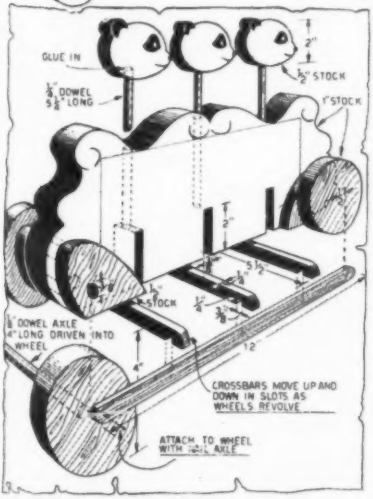


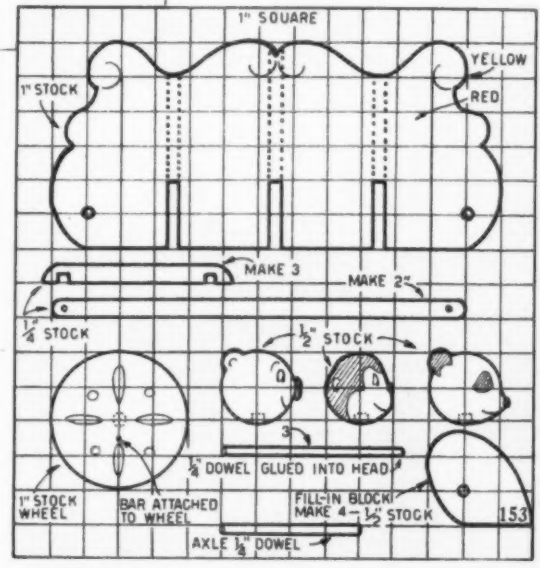
"PANDA" JIGGLE WAGON



SCRAP lumber may be used to make this comic wooden toy for small children. Three wooden animal heads move up and down and at various angles as the circus wagon is pulled along.

The wagon is jigsawed from 1" stock. Three slots, 2"x⅜", are cut in the bottom and three ⅜" holes drilled from the top into these slots. Four fill-in blocks are cut from ½" stock and nailed to the four corners of the wagon, and two ⅜" holes drilled for the axles. Drill ¼" holes in the wheels (1" stock 4" in diameter) and glue them to the ¼" dowel axles. The wheels must move with the axles which turn in the wagon section. A rod (¼" stock ½"x12") is then attached to the front and back wheel on each side with a nail axle ½" from each end and ½" below [*Continued on page* 180]





Modern Houses Of Earth

[*Continued from page* 107]

in adobe bricks, or you may choose the "rammed earth" process which has become widely used in Europe and Asia.

In adobe brick construction, the treated soil is molded to the desired shape in light wooden forms. When dry, the bricks are used in assembling the wall like ordinary bricks. They are tractable and special shapes can be made easily to fit the form of architecture you want to follow. With rammed earth, known as "pise de terre" in France, large, strong wall-forms are erected and the prepared soil is rammed into the forms and allowed to dry and harden.

Soils consist of fine granular particles interspersed with clay as binder. A proper proportion of clay and sand is necessary for firm earth walls, and certain tests must be made upon the soil before any construction is attempted. Clay soil must be blended with a sand or gravel soil and a sandy soil blended with clay. All vegetable matter, humus and stones larger than one inch in diameter must be removed. When asphaltic stabilizer is to be used, the soil must not contain any alkali or other water soluble salts. Almost any soil can be adapted to either method by admixing. Coarse-textured earth, however, tamps more readily in its natural state and is therefore more suited to rammed earth than to adobe bricks, for which blending will be necessary. Heavy clay soils which contract noticeably upon drying are unsuitable for rammed earth without blending, but may sometimes be used for adobe bricks without further attention. Rammed earth, too, has an advantage in that it is the quicker construction method in damp weather for it depends less upon rapid drying.

There are a few simple ways by which you can get an idea of just how good the good earth is for your purpose.

First, mix enough water with earth taken from below the surface—usually six to twelve inches is deep enough to avoid plant roots and humus—to make a small mud ball. If the mud ball becomes hard when dried, this indicates that the soil is probably fit for earth wall construction. If the mud ball when thoroughly dry is easily crushed, it cannot be used for earth walls unless blended with other appropriate soils. Soils that clod when spaded or that maintain firm sides when excavated are usually suitable for rammed earth or adobe brick walls. If a dry lump of soil it is suitable for earth construction.

Soils that are hard in footpaths when wet and soils that form hard ruts from passing vehicles, are also suitable. Ground that has many cracks when dry usually requires blending with sandy soils or straw to prevent cracking when used in earth walls.

If the soil has so far proved suitable, it should then be tested thoroughly by ramming it into a small cube. If the soil does not have these suitable distinctions, it may be too sandy and therefore cannot be used unless blended with clay or clayish soils. Whether or not this is true, your test will show.

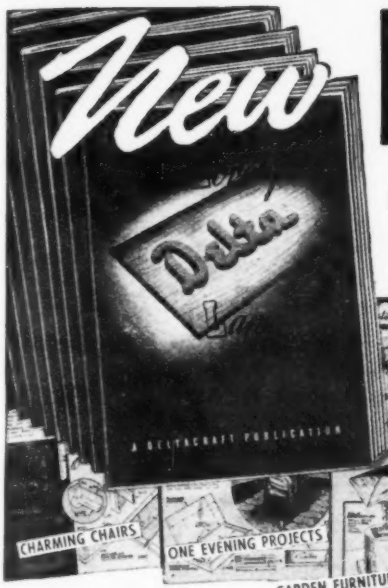
For the rammed earth test, it is best to make a simple form of wood, although such things as a pail, tub or small barrel can be used to hold the dirt for ramming. To build the wood form, obtain two pieces of wood 1" x 12" x 13" and two pieces 1" x 13" x 14" for the sides; one piece 2" x 14" x 18" for the base. One surface of these pieces should be smooth for the inside of the form. For braces, you need four pieces of wood, each 2" x 2" x 18" and two pieces, each 2" x 2" x 14". Besides screws for attaching the braces to the sides of the form, you will need four bolts, each 18" long by ¾"; and two bolts, each 4½" long. Cut grooves in the base piece for the sides to rest in, so that the insides will form a twelve-inch cube. The four longest wooden braces should be screwed horizontally to the outside of the two 12" sides of the form, so that the 18" bolts passing through holes drilled near the ends of these braces will securely hold the sides of the form together. The other two wooden braces can be attached horizontally near the outside bottom of the two opposite sides (see sketch). Bolts passing through holes in these two braces through the base piece of the form will anchor the sides of the form to the base.

This rammed earth test form when completed will hold one cubic foot of soil, and besides for testing rammed earth, it also may be used to measure materials for either rammed earth or adobe bricks.

Freshly dug earth may have the right amount of moisture to ram well. A handful of the soil should be kept moist enough to hold together when squeezed, but dry enough to break apart when dropped. Usually the optimum moisture content of soil for ramming should range from 7% to 15% of the total weight of the soil mixture, depending on the various soil textures to be used. The percentage of moisture in your soil can be found by weighing a portion of the earth when dug and weighing it again when it is dry. Then if the percentage of moisture is calculated to be less than 7%, add sufficient water to bring the total moisture content of the soil to be rammed up to the minimum. Supposing that the percentage of moisture is found to be over 15%, then the soil should be dried sufficiently before being rammed. Very wet soil cannot be rammed, for it is too plastic; a ramming stroke in one place will raise the soil in another place.

To begin the ramming test, screen all rocks larger than a walnut, all clods and vegetable matter, from several cubic feet of soil. Then make the calculation for moisture content. As an example, if the moisture content is found to be 3% add one half gallon of water to one cubic foot of soil and mix well so that the moisture will be

[*Continued on page* 182]



DELTA PROJECT LIBRARY

Over 300 Selected Outstanding Projects with all necessary photographs and working drawings segregated and typed into 9 convenient volumes

FREE—Extra Gift

With every order for the Delta Project Library we include a Free copy of "How to Make Money with Delta Tools". Extremely valuable. Gives numerous examples of successful money-making plans.

One of the greatest project library values ever offered—over 300 "cream of the crop" selections from past issues of the Deltagram—segregated in 9 convenient books, with each book devoted to a specific type of project. No more searching through dozens of books to find the exact project you want. Photographs, working drawings and complete directions on each project. Every item shop-tested. In addition, you get the valuable "Practical Finishing Methods"—a gold mine of information on latest finishing methods. Examine this remarkable value on our "no-risk" offer. Mail the coupon below TODAY.

21 Lovely Lamps—popular, pleasing designs for lamps of all kinds. Shows how to wire and connect. Many modern designs.

19 Charming Chairs—simplified, easily followed instructions, clear photographs show how to make chairs of all kinds.

One Evening Projects—a collection of dandy novelties—easy to build projects that "look like a million" but take a minimum of time to build.

Garden Furniture and Novelties—here you have the latest designs, all in one convenient book at one-tenth the price usually charged for this number of plans.

Toys, Games, Playground Equipment—ideas and designs that have started many men on a small but highly profitable sideline business.

Furniture Designs—Desks, beds, wardrobes, larger pieces of fine furniture. Many original designs are contained in this book.

Novelties—An assortment of all kinds of small interesting useful things the beginner can make. Parents are usually delighted with the things in this book.

40 Fine Tables—Tables are always the finest projects for the shop. Here you have a collection of the best in design and construction.

Small Furniture Designs—Footstools, magazine racks, sewing cabinets, mirror frames are but a few of the better pieces shown in this new book.

PLUS "Practical Finishing Methods"

The book that every shopman has been waiting for. Tells in simple easily followed instructions how to do every possible finishing operation—how to prepare the work—how to stain—fill varnish—lacquer, etc. Shows proper use of spray gun and brush. Tells how to mix your own low cost materials. Silk screen process—how to finish metal—make decorations. In fact, it's a complete guide on every practical finishing operation giving secret methods developed over many years.

ONLY $2.00 COMPLETE

Examine This Library at our risk!

DELTA MILWAUKEE

You can inspect the Delta Library without risking a penny. Simply fill out and mail coupon today. When the complete library, plus the FREE extra gift book arrives, postpaid, inspect it thoroughly. If you aren't fully satisfied in every way—you can return the library—and every penny you have paid, including return postage, will be promptly refunded—without question. The Delta Mfg. Co., 694C E. Vienna Ave., Milwaukee, Wis.

THE DELTA MANUFACTURING COMPANY
694C E. Vienna Ave., Milwaukee, Wis.

Gentlemen: I enclose $2 for which please send me complete Delta Project Library, Postpaid, plus FREE Gift Book. It is understood that if I am not fully satisfied—I can return the library and you will refund every penny I paid, including return postage.

Name.....

Address.....

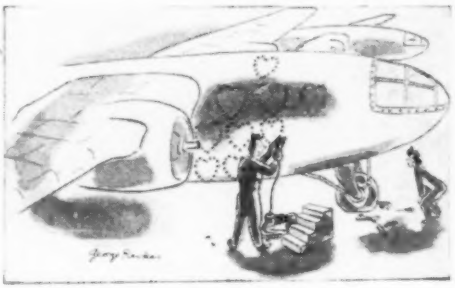
City.....*State*.....

Simplified Flash Peak Tester

[*Continued from page 99*]

for the highest speed to be used; place a flashbulb in the gun; wind and start the turntable revolving; hold the gun about 2 feet over the camera lens, pointing it down into the lens and the adjacent open hole as shown in Figure 1, and make a synchroflash exposure. Upon development, the bromide disk should reveal the following:

Along the edge of the disk, an arc of graduated density will appear where the bromide paper passed under the exposed hole during the flash period. This depicts the total flash duration, with its densities corresponding to the various intensities of the light as the bulb approached its peak and then faded out. At one point on the arc, there will be a dark over-fogged area caused by the peak of the flash.



Now, if your synchronizer is accurately adjusted, a dark line will also appear along the radius of the circle pointing directly into the middle of the densest portion of the arc. This line is recorded by the burning flash lamp at the instant the camera shutter is tripped through the slot in the lid cover. If the shutter trips after the bulb has passed its peak, the line will point to the fading portion of the arc. If the shutter trips before the bulb has reached its peak, the line will point to the opposite side of the peak density of the arc. If no line appears at all, the shutter is tripping either before the bulb has been fired or after it has burned out. Just how far off your synchronizer is can be determined by how close the line points to the middle of the peak density. It is then easy to make any necessary adjustments in your synchronizer.

Cameras with focal plane shutters should be laid over the slot so that their curtain slits will travel along the length of the slot during the exposure. The length of the slot should be equal to the distance the curtain slit has to travel. The developed bromide sheet will then show a spiral line, instead of a straight line pointing at the density arc. Pencil lines drawn outward from the center of the disk so that they touch each end of the spiral line in passing, should also touch or be within the dense peak portion of the arc, as shown in the diagram of the top of page 99—if the synchronizer is in "sync." The spiral should cover a length of the paper radius equal to the length of the focal plane of the camera tested.

The first fire engine in the United States was brought to Salem, Mass., from London in 1749.

Brome Etching

[*Continued from page 96*]

Now to the making of an etched print:

Make a test strip as you would for an ordinary print requiring a three-minute developing time. When this exposure is correct, note the exposure time. When exposing the print to be etched, give twice the exposure that was required for the correct test strip and develop for four minutes in your favorite developer. Your print now should be very dark. Put the print into a tray or a sink containing plain water (do not use a short stop bath).

Mix your working solution while the print is in the water. It will keep for about fifteen minutes only! Now, pour about one-third of the working solution into a clean tray; remove developed print from the water, and immerse it face-up in the etching solution. Make sure the entire print is immersed and is lying flat. Rock the tray very slowly, and after a few seconds, turn on the white light, continuing to rock the tray s l o w l y. (Rapid rocking will cause the edges of the print to etch out completely because of the strong backwash from the sides of the tray.) Either slow rocking of the tray or use of a tray larger than the print to be etched avoids this. After about two minutes, the print will begin to lighten and the etching solution will change from a deep purple to a light color—a sign that is becoming exhausted. The print will eventually take on a blue tone.

When the etching bath has become exhausted, pour off the solution and pour in half of the remaining working solution and continue rocking the tray slowly. If the print does not become light enough in the second etching bath, pour off the exhausted solution and use the remaining working solution. When the print becomes light enough or a bit lighter than a normal print should look, remove it from the etching bath and immerse it in the tray of hypo.

The bluish hue the print took on in the etching bath will disappear like magic, and a beautiful deep-tone etched effect will become apparent. Fix the print for ten minutes and then wash for one hour. Dry as usual.

If your print has come out too dark because you stopped etching too soon, it can be etched again after it has been washed free of hypo. To clean the etching bath tray, use any type of hypo.

When making an etched print, use only clean tongs, or your fingers—to avoid stains on the print.

More than 30 different plastic parts are being used in new radios.

"THIS WISDOM MUST DIE!"

Truths That Have Been Denied Struggling Humanity

FOR every word that has left the lips of bishops or statesmen to enlighten man, a thousand have been withheld. For every book publicly exposed to the inquiring mind, one hundred more have been suppressed—*damned to oblivion*. Each year of progress has been wilfully delayed centuries. Wisdom has had to filter through biased, secret sessions or ecclesiastical council meetings, where high dignitaries of state and church alone proclaimed what man should know.

Are you prepared to demand the hidden facts of life? Will you continue to believe that you are not capable of weighing the worth of knowledge that concerns your personal freedom and happiness? Realize that much that can make your life more *understandable* and *livable* has been left unexplained or intentionally destroyed. At first by word of mouth only, and *now* by private discourses, are *revealed* those truths which secret brotherhoods preserved in ancient temples and hidden sanctuaries, from those who sought to selfishly deprive humanity of them.

THIS *free* BOOK OF EXPLANATION

Let the Rosicrucians, one of these ancient brotherhoods of learning, tell you about these amazing truths, and explain how you, too, like thousands of others, may now use them to enjoy the fullness of life. The Rosicrucians, (not a religious organization) invite you to use the coupon opposite and receive the FREE copy of the fascinating, Sealed Book, with its startling tale of *self help*.

The ROSICRUCIANS (AMORC)
SAN JOSE, CALIFORNIA, U. S. A.

Scribe U. A. P.
THE ROSICRUCIANS (AMORC)
Rosicrucian Park, San Jose, California, U.S.A.

Please send me your FREE Sealed Book. I am sincerely interested in learning how I may receive these long-concealed facts of life.

Name.....

Address.....

Build Your Own Bicycle

[*Continued from page 110*]

remainder of the 5/8" lumber. These should be between 25½" and 28½" in length, depending upon the height of the rider. For a man six feet tall, 27½" is ideal. It is imperative that the ends on these two pieces be perfectly square, since this is to be the all-important steering gear. The remainder of this lumber should be saved for blocking up the space between the front forks.

From the 1"x1⅜" lumber, two pieces are then cut, one for the horizontal bar and the other for the front bar. The remainder of this size lumber should be kept for the seat post, the length of which will vary according to the height of the rider. The ends of the longer of the two pieces should be cut with 70° and 51° angles, while the shorter should have 67° and 55° angles.

The front block should next be cut to size as shown in the diagram, as well as the spacing blocks for the front forks. By referring to the diagrams, the craftsman should have no trouble in designing the odd shaped ends on the horizontal bar, and seat post.

After all parts are cut to size and trimmed up, the entire frame should be sanded down until there are no sharp corners or edges. Next comes the job of assembling—and a simple job it is.

First the front frame bar is fastened to the inside of the two flange plates. After placing the board in position, a hole is drilled into it at the proper spot, and the bolt of the right size is placed into the position and loosely fastened. The seat post is next fastened into position on the hanger assembly, and finally the shorter portions of the rear forks are fastened to it. These two pieces are attached to the outside of the flanges rather than the inside, as were the other two bars.

The horizontal bar and the two other pieces of the rear forks are next attached to the seat post as shown in the diagram, and the frame is assembled. Thus far, only stove bolts have been used and only in the maximum sizes that fit.

The head on the bolt fastening the rear fork pieces to the flange plates should be ground down to provide sprocket clearance.

The front block should next be bolted to the front and horizontal bars by means of four half hinge plates cut and drilled as shown. Into each plate, one hole should be drilled so that the bars will have sufficient sturdiness.

Next, two heavy 8-inch strap hinges for the front and rear forks should be cut as shown in the diagram. At the same time it would be wise to cut the axle slits. The four plates are next bolted to the inside of the forks, front and rear. This will also fasten together the two halves of each branch of the rear fork.

After the assembly of the rear fork is completed, it might be wise to fill in the unfilled space around the hanger assembly with wooden blocks. Only two blocks will be necessary, the first between the seat post and the front bar, and the other extending around to the back of the front bar, between the two fork pieces, and between the bottoms of the hacked-off flange plates.

Now, the gooseneck should be cut to desired height and bolted to the metal plates cut and drilled.

The entire plates should now be cut from one hinge to provide dummies, which enhance the appearance of the steering assembly, after which approximately six inches are cut off one plate on each of the two remaining hinges. The pins are then taken out of these hinges and one complete plate is fastened to each side of the front block. Around the incomplete plates, the front forks are fashioned, using extra pieces of oak for filler as shown. The 6-inch machine bolt is then used to assemble the front fork to the frame by passing it through both hinges.

With the remaining machine bolts (the others were used in fastening the metal plates to the gooseneck), the gooseneck and plates are attached to the front fork.

The entire frame is now complete and the bicycle may be painted. Red auto enamel is advised because of its permanence and its cover-all effect. A paste wood filler should be applied to the oak before painting. Two coats and perhaps more will be necessary to hide the difference in material between metal and wood and to fill any cracks in the joints.

Next, the hanger should be put through the pipe flanges, with coffee can shims used between the bearing cups and the socket, if necessary. These shims should be satisfactory, since all that is necessary is a snug fit. There will be no wear on them.

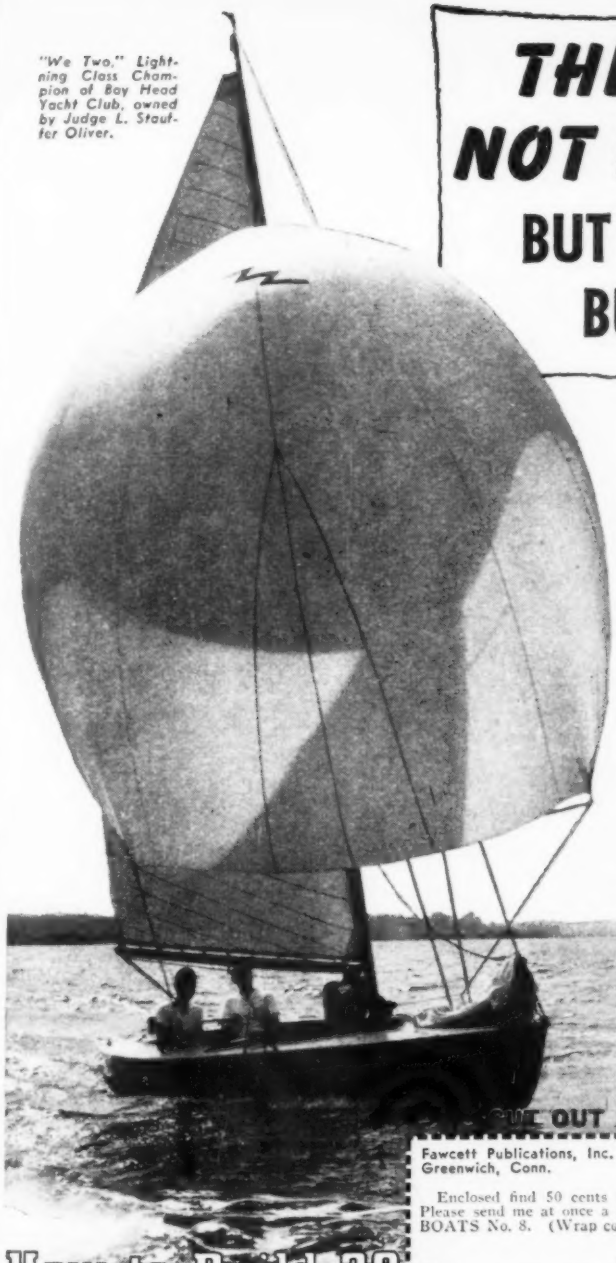
The wheels should now be placed in position. It should be necessary to force the forks apart to accomplish this. Before the rear wheel goes in, however, it will be necessary to put in the chain. It should fit snugly around the front and rear sprockets, with enough play so that one may move the bottom of the chain from one-half to one inch.

There is only one more step in the construction of the wooden-framed bicycle—and that is putting on the handlebars and the seat and riding away

---

Testing and breaking in aircraft engines is done more efficiently by a new apparatus now being installed in plants. More accurate data and recordings are made by one man from a single control point, the manufacturers report, than by previous methods which required constant attention of at least two trained engineers and an assistant. A maze of wires and tubes connect the engine with testing devices which are remotely controlled by the test engineer sitting at his desk outside the test room.

Luminous bait for fishermen, molded of phosphorescent plastic, has recently been patented.



"We Two," Lightning Class Champion of Bay Head Yacht Club, owned by Judge L. Stoutter Oliver.

THIS BOAT NOT FOR SALE

BUT YOU CAN BUILD IT!

THE war has brought the sale of new boats to a virtual standstill BUT—you can have a new boat next spring! Why not build it yourself!

The big new illustrated issue of HOW TO BUILD 20 BOATS tells you exactly how to do it, and contains a selection of boats ranging from a paddleboard to cruisers and auxiliaries over 30 feet in length! All are handpicked for the amateur builder and are presented with *complete* plans and building instructions that enable even the inexperienced craftsman to turn out a GOOD boat.

Featured is the LIGHTNING CLASS racing sloop, whose plans are published here for the *first time*, by special permission of the Lightning Class Association. Also included are plans of Captain Charles Borden's famous *Confucius*, 17-foot offshore cutter that crossed the Pacific twice and covered 8,000 ocean miles!

Send 50 cents with the coupon below for your copy of this great book, or buy it at your newsstand. But do it today!

CUT OUT AND MAIL TODAY!

Fawcett Publications, Inc. MI-3
Greenwich, Conn.

Enclosed find 50 cents in checks, cash, money order or stamps. Please send me at once a copy, postpaid, of HOW TO BUILD 20 BOATS No. 8. (Wrap coins in paper before placing in envelopes.)

Name .....

Address .....

City ..... State .....
(CANADIAN ORDERS NOT ACCEPTED)

How to Build 20 BOATS

How I Kill Nazis At Night

[*Continued from page* 38]

all, they paid no attention. The last thing in the world they could have expected was an English fighter hovering over their own base.

The ground crew cleared the field below us. The landing lights flashed on, and against them were silhouetted the homing bombers. I swept down, taking my time and covering my chosen target carefully. I let fly—and the next thing the ground crew knew one of their bombers was coming down in pieces about their heads. They must have been very much surprised.

If I had drawn a blank that night I might never have tried the stunt again. As it was, the initial success encouraged me to keep on. Sometimes I varied the program; instead of waiting for the Germans at their base, I would pick up a flight of bombers in the English skies and follow them home. The ground lights flash on—

Then it is an affair of moments, of split seconds filled with action. I select my bomber. I pounce upon him from the darkness. Red flame from my guns pierces the black night. Down he goes—and away go I, laughing a little to myself.

If possible I would always hold my fire till the Nazi was no more than a few hundred feet above the field, just ready to land. I figured the crash would finish anything my guns had left undone.

I had one lucky streak in the beginning when I knocked down eight bombers in five nights. That attracted some attention, and since all these little victories were achieved by night, one of the London newspapers referred jokingly to a mysterious Czechoslovak flier in the R.A.F. who could see in the dark like a cat. My comrades were amused—and that is why they call me Cat-eyes.

My early work was rather crude, of course, but the R.A.F. command took up the idea. They developed and improved it until it was a new technique, very simple but beautifully effective. As a direct result of it, the Germans are forced to move their air fields farther inland, beyond the flying radius of our pursuit planes. This means their raiding bombers must fly much farther and be in the air, exposed to attack, much longer.

My best night, and one I shan't soon forget, was May 4th of this year.

I had hung around over one air field for ten minutes or more without seeing any sign of life below, so I gave it up and flew to another field not far away. Ah—how different things were there!

My heart leaped with joy as I saw six murderous Heinkels circling at about 2,000 feet, waiting to land. I wasted no time. I came flashing in behind one of them, pressing the buttons of my guns. It was a short burst, but one of his engines caught fire and he nose-dived to the ground.

My luck was still in. I picked out another Heinkel and a one-second burst was enough for him. He went down in flames, landing in a patch of woods near the air field.

[*Continued on page* 161]

Alabaster Carving

[*Continued from page* 111]

smooth, bring to a slight polish with finer grades of sandpaper, and rub to a high polish on a piece of canvas stretched and tacked to the bench top. Round the edges slightly, and with a veining tool or a nail, shaped for the purpose in the drill press, and with a jig set up to guide the edge of the plaque, groove a narrow line ¼ inch in from the edge for added effect. After drilling two holes 1 inch apart almost through the plaque, lay it aside for the time being.

Your carving itself may be any suitable profile, such as a person's head (like Lincoln and the girl shown) or a sail boat. If you lack ideas of your own, go through some old magazines and pick a silhouette you like from those pages. A dog, bird—in fact, almost any idea that strikes your fancy—may be used. The silhouette stock should be a little thinner—say ¼ inch—and you can work this down with the tools mentioned above or, if you possess one of the high speed hand routers, your work will be still easier.

When the silhouette is completed, sand the back smooth, bore holes to take the dowel or copper wires (as in the diagram) and glue the whole assembly together under slight pressure. When the glue has set, give the plaque and silhouette a coat of sprayed lacquer or shellac, rub down lightly with No. 3 or No. 4 steel wool and finally wax.

Bore a tiny hole in the top and turn in a small brass screweye with a brass ring to hang to the wall.

Doctor Of Tools

[*Continued from page* 41]

designing and building candy-making machinery, installing giant gas engines, and running a garage. When ill health bothered him, he and his wife climbed aboard a "house-car" and toured the country for two years. The trip evidently put him back in the pink of condition, for he returned to set up a retail radio business, and build a complete house with his own hands.

That's probably why he feels that his present job is just a sort of artistic loafing. He modestly insists that he's just wasting time. But his so-called loafing continues to put more American fighting planes into the air than ever before—faster and better, than ever before. America can use that kind of loafing.

The British War Office finds that about one suggestion in every 400 submitted by inventors is useful.

At America's defense outposts on the west coast of Alaska, service men find the sudden high winds called "willawaws" one problem in flying and shipping.

How I Kill Nazis At Night

[*Continued from page* 160]

The remaining four bombers woke up to what was going on. They tried to scatter so their ground guns might fire at me without endangering them. I had to act quickly. I managed to attack once again. My special Hurricane, a four-cannon job, did its work handsomely. I saw my shells strike the Heinkel full in the body and it started to fall steeply. I lost sight of it for perhaps thirty seconds, then, but as I circled the field once more before leaving I could see three separate piles of burning wreckage below me.

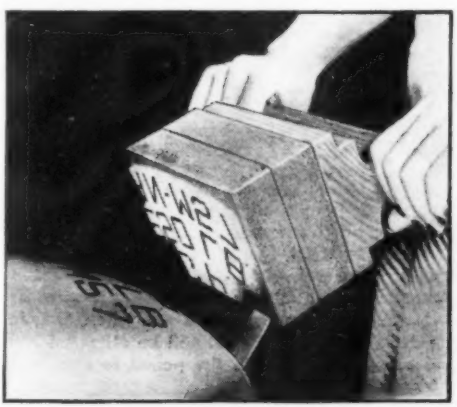
That was a good night's work and I felt very pleased while flying home through the dark. Three Nazi bombers that would bomb no more women and little children, and in my thoughts I dedicated them in three worthy directions. One I gave to my country; another to the English, who have been so kind to me; and the last to all Czechoslovaks, wherever in the world they may be, who are still fighting the fight for freedom.

Kisses, Bombs or Tissue Paper

An air-floated super stamp for marking irregular shapes or fragile surfaces, first produced to meet a specific assignment—identifying the noses of bombs, shells, and torpedoes—has proved equally practical for marking cylindrical or irregular-shaped objects such as cans, buckets, drums, etc., marking as much as ⅓ of the circumference in a single impression.

The construction permits stamping large lettering on fragile surfaces or on the sides of corrugated boxes which might cave in if impressed with an ordinary stamp. No special skill or strength is required to make perfect impressions, and unskilled operators have attained speeds up to 600 or more per hour.

The stamp is used in connection with an ordinary stamp pad, impregnated with special ammunition marking ink that air-dries in two or three minutes, is waterproof, non-caking.



Raiding with the Rangers, 'cross country scouting, front line dispatch riding . . . those are some of the motorcycle jobs that call for red-blooded riders with daring and courage, cool heads and resourcefulness.

In flashy, flexible performance on a dozen battle fronts, Indian Motorcycles are backing up these riders with all of Indian's famous power and speed and sturdy dependability. The soldier who rides an Indian knows there's no safer motorcycle built.

And you'll know it, too, when you ride the great new Indians that will be yours for good times and economical transportation after this war. In the meantime, let your Indian dealer help keep your present motorcycle in fighting trim . . . and ask him about his reconditioned "buys".

INDIAN MOTOCYCLE COMPANY, SPRINGFIELD, MASS.

Indian

BUY WAR BONDS NOW

★ ★ TO BUY AN INDIAN LATER ★ ★

Mystify With Magnets

[*Continued from page* 117]

deck—the older the better—and cut an oblong opening in each of about 40 cards. Glue these together in two books of 20, and glue a plain card to one side of each book. At one end of the opening in each of them, cement a small rivet. One magnet, with the end of the cord cemented to it, is placed in the slot or opening in each book as in the sketch. A cover card is then glued over the opening in each. The other cards are punched for passage of the cord. Glue very short pieces of cord to each of the inside cards so that it will appear that the cords are severed. When the deck is held together you can pull either of the cords and the other cord will be shortened, due to the fact that the two magnets will follow each other inside the openings. You can separate the deck as often as you wish and the action will continue when the halves are placed together again.

The Buoyant Drinking Cup

Magicians like to float things in the air with the greatest of ease and if you wish to do a little after-dinner floating, nothing could be easier and more mystifying than this particular levitation. Required props are a paper drinking cup and a steel dinner knife, both ordinarily available. When you place the handle of the knife inside the cup, the latter clings tenaciously, and you can carry the cup around the room by this improvised handle, to the wonderment of all. The audience will find nothing sticky about the cup or knife; moreover, they cannot duplicate the feat no matter how hard they try. There is a good reason. When you pick up the cup in your left hand, in the palm is one of the small magnets. This is held naturally against the outside of the cup. The knife handle is placed opposite the magnet, the two cling together and the cup floats. Allow the magnet to drop back into your hand before passing the cup and knife for examination and trial.

The Acrobatic Match

The match in the photo is a very good acrobat for it can hold itself off balance with only one end resting on the edge of a match box. You will need to switch match and box after exhibiting the trick because a length of fine needle is embedded in the end of the match stick, and one of the small magnets is fitted underneath the bottom of the match box drawer.

Sliding Glue

This trick is known to a few amateur magicians and it has been given the name of "Sliding Glue." The reason is apparent. Three or four playing cards are held in one hand and a cigarette placed on the face of the front one. It adheres as if glued in place. *Now* the performer slides the front card from the remainder, but instead of continuing to cling to it, the cigarette remains in the same position, even after all but one of the cards have been slid from underneath it. It should be mentioned that a special glue is not required. Instead, push a short, heavy steel needle inside the cigarette. With two fingers hold one of the tiny magnets at the back of the cards. The cigarette will cling and your audience will be much impressed.

Dead or Alive?

Do the names that dying persons leave behind them have an aura, an almost imperceptible influence that makes them different from the names of living people? Suppose, for instance, that a number of names of live persons are written on separate slips of paper, which are then crumpled into little pellets, and the name of a dead person treated likewise and the pellets well and fairly mixed. If you were to pass your hand over them, you'd expect nothing untoward to happen, unless you were familiar with this trick. In that case, even were you blindfolded, one of the pellets would leave the others and appear in your hand. Unrolled, it would be found to have on it the name of the dead person.

Mystic aura or not, it is simple to do if you take care to roll up a tiny steel ball bearing when making a pellet of the dead person's written name. On one finger wear a ring having one of the small magnets attached. It will attract the "dead" pellet from any number of unprepared "live" pellets when your hand and the ring are brought near. Take care to dispose of the steel bearing as you unroll the slip of paper.

The Rising Card is a very simple trick. In effect, a spectator chooses a playing card and returns it to the deck. The deck may be shuffled. Holding the deck in one hand you merely touch it with the end of a pencil and immediately the chosen card rises, following the pencil out of the deck.

The pencil should be a large one—as in the case of some mechanical pencils—so that a tiny magnet can be concealed inside the end cap, making the latter highly magnetic. With a sharp knife, gently and carefully slit open one end of each playing card, inserting the knife between the piles. In this space put one or two strands from a wad of new steel wool; then cement each card end down and place it under weights so that the operation will not be visible afterwards.

The cards may be in any order but the treated ends must all be together. After a card is selected, reverse the pack. When the one card is returned, it will be reversed with respect to the other cards. Hold the deck loosely when touching it with the magnetic pencil and, regardless of where it is in the deck, the selected card will be attracted and will cling sufficiently to the pencil to rise from the pack.

Your Invention Clinic

[Continued from page 12]

suggest that you treat this project as a sort of a gambling venture. If you feel that you can afford to take a chance in applying for a patent we would suggest that you do so. This invention does not strike us as being an immediate money making proposition when applied to screen doors.

A Safety Wood Screw

Earl W. Stevens of New Britain, Conn., submits a design for a wood screw prepared with a diagonally drilled hole through the head into which a nail can be inserted for locking the screw firmly in place after it has been driven into the wood.

ANSWER: *The only thing wrong with this idea is that it is illustrated in the book issued by the U. S. Government dealing with early American patents. If you will refer to that publication you will see many designs of non-removable screws.*

Electrical Level—Bowling Alley Pin Annunciator

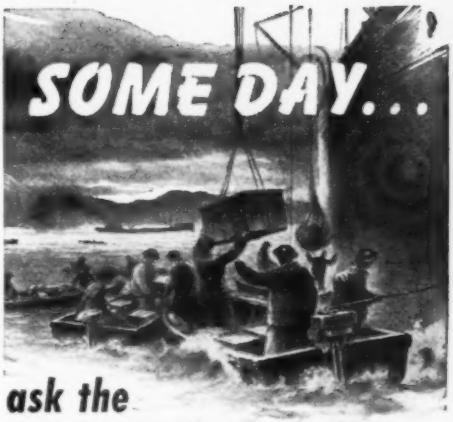
Raymond F. Ball, Utica, N. Y., sends us a plan for an electrical level and another for an electrical annunciator system intended to indicate which pins in a bowling alley are left standing.

ANSWER: *Just why should anyone want to use an electric level of the "portable" type? This design cannot be as accurate as the level which is in common use today. It depends on a mercury contact which does not always break at precisely the same point. Consequently, its use must be augmented by the addition of the common air bubble, a factor which you have foreseen and specified. We think the item is useless, unless you have in mind the application of this level to a certain manufacturing process wherein it becomes necessary to make many repeated fairly accurate level readings. If so, we reserve the right to change our opinion upon receipt of further explanation from you.*

The objection to the electrical contacting device for bowling alleys is that dirt and dust will interfere with its proper operation. Furthermore, after the alley, made as designed by you, has been in use for some time the contacting springs would loosen. The plugs then would drop below the level of the alley and interfere with spinning pins and accuracy of ball movement. Also, if a pin dropped on its side and came to rest on one of these plugs the annunciator would show that it is still standing whereas, in fact, it is down.

There are better methods than the one you propose already in use. The simplest perhaps is to have a disk of metal on the bottom of the pin which closes the circuit across two semilunar metal disks mounted flush with the surface of the bowling alley. Then, any pin knocked over registers

[Continued on page 164]



ask the boys from the Aleutians!

THE storm-swept roadsteads of the Aleutians were never made for "happy landings". No placid harbors here, no capacious wharves or rippling beaches! So, crashing through gale-lashed breakers, the dories, skiffs and work boats go . . . landing on craggy coastlines . . . handling ton-by-ton the precious cargoes of men and materials, food and supplies, that must be safely ferried from ships to shore.

It's a "destruction test" for small boats — and for hundreds of rugged Evinrudes that help drive them. At many a tough spot, a few short weeks is long life for battered boats . . . but salvaged motors drive *on and on* . . . peacetime products proving their stamina in grim and relentless wartime service.

Today, new Evinrudes are being built for only one purpose . . . *to help win the war.* When that need is past . . . and you're thinking of buying a new motor again . . . just "ask the boys from the Aleutians" — and from many another front! Ask *them* what they learned about motors, out there where the going really gets tough!

EVINRUDE MOTORS
5008 North 27th Street
Milwaukee, Wisconsin

Evinrude Motors of Canada, Peterboro, Canada

EVINRUDE
OUTBOARD MOTORS

★ Every War Bond you buy helps speed America's Victory. Then, good fishing to you!

Your Invention Clinic

[*Continued from page* 163]

and there can be no false record when a pin lies on its side. We advise against further action.

Instantly Adjustable Wrench

Merrill E. Prichett, St. Ignace, Mich., sends us an illustration of a plan for permitting speedy adjustment to a wrench of the monkey, Stillson or Crescent types.

ANSWER: *In accordance with our practice we are not disclosing the details of this idea because it possesses features which we consider very much worth while. We suggest that you have a search made by a patent attorney. There are vises on the market today which operate exactly the same as your proposed wrenches. But there are times when these vises release suddenly, due of course to carelessness of the operator. But such release results either in a damaged tool or skinned knuckles. Your invention would be more marketable if you could eliminate this weakness. Also, it would be applicable to a greater number of tools.*

We would recommend that you look into this matter very carefully before devoting time to making models. Work on improvements and perfect them. Then protect the improvements.

"Emergency"

Winner of the First Prize in a recent contest of the American Red Cross National Photo Awards was the picture above, taken by Glen Fishback, of Sacramento, California. The prize was a $200 War Bond.

Heat From Tin Cans

[*Continued from page* 118]

fire box into the ash pit. Then the fire dies out.

However, fine coal can be kept from sifting down through a coarse grate by throwing a couple of tin cans onto the fire before shoveling in the buckwheat coal. The tin cans become filled and covered around with the fine coal. As the temperature rises the tin and iron in the cans melt. The hot metal welds the small coal particles together into large lumps. These large lumps burn steadily, give off intense heat and prevent the loose unburned coal from falling down through the coarse grates. After the large lumps are completely burned, the coal, ashes and small fragments of metal are easily broken apart and shaken down into the ash pit.

That was the way the fire was kept burning over the week-end to keep the house warm until the fine coal could be replaced on Monday with coarse coal. But the resourceful man who burned the cans in an emergency, noticed by looking at his coal bill that fine coal costs less per ton than coarse coal. So he thought that since there is as much heat in a ton of fine coal as is in a ton of coarse coal, and if he could burn fine coal for one day by using cans, he ought to be able to keep on burning fine coal and save money on every one of the ten tons he usually used during the winter to heat his six-room home.

The possible saving was sufficient inducement for him to try the idea until he burnt all of the small-sized coal delivered by mistake. That mistake turned out to be a blessing in disguise. The idea worked—for that load—and every load of coal for the rest of that winter and for the two past years.

Handy Clothes Wringer

[*Continued from page* 118]

join (A) and to lie flat edgewise on top of the sink divider, making it long enough to be flush with the outside *front* edge of the sink.

Then cut triangular piece (D) for the end, and notch the ends of it to receive holes for clamp bolts. Drill 7/16" holes in the ends of this piece at (E). Make clamp bolts by bending the head ends of each of two long 5/16" bolts to hook under the bottom edge of the sink. Put the bolts through the holes (E) and affix washers and wing nuts.

Finish the job by putting angle-iron braces at the corners, give the bracket a coat of paint, and put friction tape on the bent ends of the clamps to prevent chipping or marring the sink.

Simply clamp the wringer on the top board (Fig. 2) and it is ready to take away the drudgery of hand-wringing baby clothes or even the family wash. If the wringer handle does not operate in the right direction according to the sink fixture, take off the roller to which the handle is fastened and turn it end for end.

Because swordfish are so hard to tag, the Bureau of Fisheries has asked swordfish vessels to number their darts; so that when a fish breaks away carrying a dart there is a chance that later it will be caught again and its career checked.

Proving Ground
FOR YOUR NEW
HARLEY-DAVIDSON

BUY WAR BONDS NOW
and be all set to get
a new Harley-Davidson
when peace comes.

On far-flung battle fronts, Harley-Davidson Motorcycles are proving their rugged dependability. Out of today's great wartime experiences will come still better Harley-Davidsons for red blooded Americans to ride when Victory is won!

HARLEY-DAVIDSON MOTOR COMPANY
Department MI MILWAUKEE, WISCONSIN

HARLEY-DAVIDSON
MOTORCYCLES

"A Miracle Saved Me"

[*Continued from page 65*]

Within an hour after prayer meeting a sea gull came in and landed on my head, and you can imagine my nervousness in trying to turn around and get him, which I did. We wrung his head and feathered him and carved up his carcass, and distributed and used his innards for bait.

Captain Cherry caught a little mackerel about six or eight inches long and I caught a little speckled sea bass about the same size, so we had food for a couple of days. We divided them up equally and there was no wastage—the head, body and bones were delicious. Everybody got an equal share.

The next day I had another sea gull land on my shoulder, which I caught, but didn't have the heart to wring his throat and let him go. That night we ran into our first rain storm. Usually you try to avoid a black squall, but in this case we made it our business to get into it.

We had no experience in catching water, but we used our shirts, socks and handkerchiefs. We would get them soaked up and wring—I was the official wringer in our boat—wringing the water into the bailing bucket, a little rubber bucket, and I would mouth it out of that and force it into the compartments in the Mae West life vests and then we would ration it from there on.

For the first few days we were rationed on the basis of two sips per man. That is about one-half a jigger, and then we were able to catch more water and build it up.

During the storm Captain Cherry's boat went upside down and we lost all of our flares, medical first-aid kit, and other things and didn't get them back. The little boat broke away. They paddled after it and brought it back and tied it through the storm.

But on the night of the eleventh this boy that died was getting very low and in spite of the fact that the temperature was 78 to 80 and the water was warm, the waves were breaking over us continually, and because of the combination of wind it was like being doused with ice water. So I moved him over from the little boat into our boat and cuddled him like a mother would a child, trying to give him the benefit of the warmth of my body and did for two nights, particularly from midnight until daybreak. The mist was deadly.

The night he died, in the evening, he wanted to get back into the little boat and we switched. At about 3 A. M. I heard his final gasp. In spite of the fact that I had taken men out of burning race cars and airplanes, I have never had that experience before and I was afraid to make any decision until daylight.

At 6 A. M. we pulled together, I examined him thoroughly and pronounced him dead. I asked

[*Continued on page 166*]

"A Miracle Saved Me"

[*Continued from page* 165]

two of the boys to double check me, witness and verify my decision. We stripped him, lifted him overboard gently and he disappeared. It was rather a difficult thing to do, one of the hardest jobs I have ever had to do.

That left the seven of us. One of the boys cut loose—the little engineer Bartek, who was alone in the boat—the boys had switched and changed off—on this night unbeknown to us, and the next morning he was probably three-fourths of a mile away. He decided by this time he wanted to get back. The cause of it I don't know, other than a mental upset.

We tied up again and then the minds began to crack. I say to you that I know things about these men's lives that probably no other living soul knows. Any sins of commission or omission were confessed. The only thing that saved me was that I didn't get time to get started on my own life or I would probably be talking yet.

On the night of the seventeenth day, or evening, we saw our first sign of life. Then we saw a pontoon single-engine plane about five miles away. We had been trying to keep on the alert and keep someone on the watch all the time with ears and eyes open day and night, which became more difficult as time went on. But this little plane went by probably five miles away. We waved frantically, yelled, which meant nothing. He went on by and didn't come back; it was rather heartbreaking. The next day two of them came out and again they missed us. The following day there were four of them and they passed us up, two on either side, about four, five or six miles away, and though we were all tied together and the rafts were yellow, it is probably one of the most difficult things in the world to be able to see that small an object when the breakers are in action.

As I said before, we didn't know where we were; we knew no one else knew. Most of the boys were afraid that we might die and no one would ever know whether we were dead or alive, as is still the case with Amelia Earhart, because that is a terrifically big ocean.

I thought we had landed west of our original destination. The only thing we had to go by was a watch, one watch—the others all went haywire on account of the salt water. We checked the rise and setting of the sun. To try to keep our drift, we worked up a sail with a shirt on the oars, and our drift was in a southwesterly direction, but we didn't know how much so. I was afraid we were heading for a group of Japanese-held islands and we had a double fear of being captured and made prisoners. We knew we wouldn't last long under those circumstances.

The night of the twentieth day, under protest, we broke up. Everybody went their own way. Captain Cherry in the little boat alone, with the co-pilot, navigator and the radio operator in the other boat. In my opinion, we couldn't have—the

[*Continued on page* 168]

Priority-Proof Model Plane

[*Continued from page* 127]

binding together and doping the ends of a suitable length of wire. If you lack wire, make it of bamboo. All it does is assure that the shape of the fuselage won't vary. When completed, give the fuselage a coat of Duco, or lacquer.

A notch is cut on each side of the cone at the tail end to take the tail rubber hook. Light iron wire should be cemented around the edges of these slots to prevent the tension of the rubber band from tearing the hook forward through the paper. A small wire ring around the outside of the small cone at the nose is cemented on to keep the nose opening in shape to receive the nose piece containing the propeller bearing.

The nose piece is a cylindrical paper tube about an inch long with a circular white pine cap on the forward end. A hole is bored in this to take the bike spoke shaft. Whatever type of thrust bearing you use will rest against this pine cap. The cap should be made from two piles of 1/16-inch pine, cemented together with grains at right angles.

The center of gravity is found in the usual way after the fuselage is completely assembled with rubber in place and tail covered. Then the wing is attached with one third of its chord ahead of the balance point and two thirds behind. Cover the wing before attaching it. The wire wing mounting struts are shaped to fit the underside of the fuselage, and are bound on with linen thread. A little rubber cement or a short piece of adhesive tape can be used to hold the bound-on wing mounts at the proper points on the fuselage, and makes it easy to remove the wing for transportation.

Between 3 and 4 degrees incidence is right for the wing, and may be set by either bending the wire struts slightly or by sliding the upper end fore and aft. It's easiest to measure it from the floor when the fuselage is blocked up level.

Protective Alarm System

[*Continued from page* 123]

nothing breaks an external circuit, this is all that happens. Relay No. 1 and the lamps draw a small quantity of current, the amount depending on their combined resistance and that of the external circuits.

If an external circuit is broken, relay No. 1 releases its armature, permitting its switch points to close. This rings the bell and energizes the coil of relay No. 2, causing this relay's contacts to close and establish a direct circuit from battery to bell and to the coil of relay No. 2. If the external circuit is restored, or shorted out by switch No. 1 or 2, relay No. 1 opens its contacts but the bell continues ringing because current from the battery is by-passed through relay No. 2; and this current also energizes the coil of No. 2 relay. Only the switch will stop the bell.

HOW TO GET INTO AVIATION—NOW

by C. S. (Casey) Jones

NO. 4 in a series of advertisements describing the free training and opportunities now available in aviation. Addressed to the thousands of men and women who wish to prepare themselves for war service in this key industry.

C. S. JONES

One of the most interesting opportunities in aviation, and which provides immediate employment, is offered by the War Training Program of the Civil Service Commission.

If you are 17 or over, a U. S. Citizen, are physically able to work, and have two years' high school or equivalent, you may apply for one of the many jobs now open to civilians as employees of the War Department, in aviation.

Under a continuing program, the Civil Service Commission is accepting applications from both men and women who meet above requirements. Men classified 1-A, or persons now employed at their highest skills in defense industries, are not eligible.

Upon passing the aptitude tests, you are given three months' special training in an accredited aeronautics school, and receive pay for this period of $100 per month. You are assigned to one of five courses: *Aircraft Instruments, Aircraft Electrical Installations, Aircraft Sheet Metal Fabrication, Aircraft Propellers and Hydraulics* or *Aircraft Engines.*

After completing the training period successfully, you are employed at a United States Air Depot, at base pay of $125 per month for 40-hour week, with 50% increased rate for overtime. You are employed by the Department of War, but *not* in the Army.

After taking up your duties, you will find ample opportunities for advancement and increased pay in your trade, depending upon your experience and abilities.

For further information, write or call at the U. S. Air Depot, Rome, N. Y., or N. Y. State Education Dept., War Training Program, 20 West 44th Street, New York City.

C. S. Jones
President

ACADEMY OF AERONAUTICS, *La Guardia Field, N. Y. C. (Awarded Efficiency Banner of First District Army Air Forces)*
CASEY JONES SCHOOL OF AERONAUTICS, *Newark, N. J.*

Engineering and Design courses still open for private enrollment to qualified applicants. Mechanics courses devoted exclusively to military and government contract training.

Training the Key Men of Tomorrow in Aviation

AFTER THE WAR

WILL YOU BE FISHING FOR *FUN* OR FISHING FOR *FOOD*?

If we should lose this war, it COULD be that you'll be fishing for food instead of for fun. And it might be food for somebody else.

Freedom from want, freedom from fear, freedom to follow our chosen pursuits—these are the things we are all fighting for. And these are the things that move men, money and management to turn out more and more of better fighting equipment.

It is our business normally to help you "fish for fun." We can't help you to do so now because the Johnson plant, home of Sea-Horse Outboard Motors, is given over to war work—one hundred percent. "Sea-Horse precision" is now applied to war products. Johnson management and men are working harder at this job than any at which they have ever worked before. All to the end that none of us will ever have to "fish for food."

JOHNSON MOTORS
200 Pershing Rd., Waukegan, Ill.
Johnson Motors of Canada, Peterboro, Can.

JOHNSON SEA-HORSES for *DEPEND*ability

"A Miracle Saved Me"

[*Continued from page* 166]

three men couldn't have lasted another forty-eight hours.

Captain Cherry was found by the machinist's mate in this one plane, the Navy plane, and the other three boys drifted on to an unoccupied island and were on it for one and one-half days when the natives from another island found them.

In the afternoon our boat was sighted. We saw the two boys go by and then they came back from the sun direction and they hit us right on the nose. One of them came down and circled very low and waved. I could see the smile on his face. I waved back frantically to let him know we were not dead and then they went off over the horizon. I found out later they were about out of gas, but they came back about an hour later.

In the meantime a squall blew up and they lost us. About thirty minutes later they came back through it and hit us right on the nose. One of them stayed there and circled while the other one left. The sun kept going down, and the fear was that if he didn't land soon, he would not be able to and we would be lost again. About that time it was two thirds dark, the sun had gone then. I couldn't see how he could possibly land without cracking up. He let go with a flare, his Very pistol, then a minute later another one; then over the horizon we saw the blinkers of a boat, which turned out to be a PT boat, and then he came down and landed—one of those unbelievable landings and taxied up to us.

The Ensign showed the strength of Hercules in getting Colonel Adamson up the ten-foot lift in a bouncing plane and into the cabin and the little engineer and myself on the wing. They lashed us to the body with our feet hanging over the leading edge. We started to taxi for the base some forty miles away.

I don't remember how long we had gone, some fifteen or twenty minutes, when the PT boat, which had dashed madly from some fifty miles away, came up. It was decided to take the two of us off and put us on the PT boat and then the plane followed another PT boat, which came up in the meantime, into the base because it was difficult to move Colonel Adamson and he was a very sick man, in addition.

They got into the base and found out that Captain Cherry had been picked up and we heard that the other three boys had landed on this unoccupied island, that the Navy was sending a doctor over to the island and that they would be brought in the following day.

Fortunately for us, the small Navy medical unit had just finished a little eight or ten cot hospital under the beautiful palm trees. The moonlight and palms made a picture that really reminded me of the stories you read about the South Sea isles. It was a Shangri-La, if there ever was one.

They worked day and night on us. When I got in the PT boat I had gotten four big mugs of water

[*Continued on page* 169]

The School Shop

[*Continued from page* 140]

one or both elevators and resembling small ailerons. In trimming, a rudder tab is also necessary for reasons we shall discover in our study of aerodynamics. A Flettner-type tab is best for this purpose but on most of the light planes a simple strip of metal, fastened to the rudder, fills the bill. It is bent to the left by hand before the ship leaves the ground—the desired angle being determined by trial and error. Once adjusted, it needs no further attention. Sometimes a Flettner in the left aileron is also used in trimming.

The control surfaces (ailerons, elevators and rudder) are *balanced* on all ships except a few of the smaller models. A balanced control surface is one in which the hinges (by which they are attached to the wing, stabilizer or fin) are not mounted at the leading edge of the surface but set some distance in back of it. When in use, therefore, portions of the surface on both sides of the hinge are exposed to the air stream, thus equalizing the pressures somewhat and making the control easier to operate. This arrangement is shown in the diagram.

The gasoline engine is the powerplant of the plane, although the aircraft Diesel engine has been experimented with and still is being considered as a distinct possibility. Its drawback is the greater weight necessary in its construction. The engine converts the potential energy of the fuel it uses to a kinetic energy of rotation which it transmits to the propeller. It may be either air-cooled or liquid-cooled, each type having its advantages and disadvantages. The air-cooled engine is more compact, lighter and less vulnerable to gunfire, but causes a great deal of drag, thus reducing the maximum speed of the plane. The liquid-cooled engine is heavier because of the added weight of the cooling agent and can be put out of action simply by puncturing the cooling system, but on the other hand it can be perfectly streamlined, thereby permitting tremendous speed. The P-40 series is liquid-cooled, as are also most of the foreign fighters. The Republic P-47 uses a 2,000 h.p. Wright radial engine which is, of course, air-cooled. The light planes use four-cylinder Continental, Lycoming or Franklin air-cooled engines, which are opposed-cylinder engines. We'll hear more of these later. The engine ring cowl on the air-cooled jobs is to reduce drag.

The propeller is also an airfoil and the reaction it derives from the air through which it passes is termed *thrust*. It is, in reality, an *air-screw*, pulling the plane through the air in the same manner in which a wood screw pulls itself into the wood when turned. Two-bladed props are common on light ships but three- and even four-bladed ones are being used on the high-powered bombers and pursuits. The P-47 uses a four-bladed prop. Theoretically, a single blade is the most efficient because with the multi-bladed types an interference

[*Continued on page* 170]

"A Miracle Saved Me"

[*Continued from page* 168]

and a big mug of beef broth before the doctor caught up with me. When we got to the base we were put on a couple of ounces every other hour.

I tried to convince them that I could take it and it wouldn't harm me, but orders are orders and we had to obey, which probably was the right thing, because within forty-eight hours they sent some PBY boats. They picked us up and took us down to the medical base, the Navy hospital in the Samoans.

That is when Colonel Adamson ran into his serious illnesses. Fortunately for me, I bounced back, and in just two weeks, through the cooperation of our good Secretary and General Arnold, there was a new ship and crew sent out from the States that arrived on Sunday and I left to complete my mission.

On Monday I followed through and got into New Guinea and found the boys there doing a most unbelievable job because everything they do and have done in the way of transportation was done by air—troop movements, gun movements, ammunition, supplies, evacuating the wounded, and under the most adverse conditions. I couldn't help but think of the fact that the old rubber in an old rubber tire was sufficient to make up two or three of the type of rafts that we were in, and if people only knew that the saving of one old rubber tire makes it possible to produce one of those rafts which might be responsible, as it has been in our case, of saving seven men, they might take it more seriously.

I hope that the trip, what hardships we had to accept or endure might prove to be a lesson to the people back home in the stimulus to drive them on to a greater peak, because without their effort and the material they are producing, our boys can't do the job they are so willing and anxious to do in the four corners of the world.

AMERICA IN 1950

IF THE AXIS WINS . . .

. . . there won't be any restaurants for *you* to select for your meals. Your restaurant will be a Nazi garbage pail or slaughter house—provided you get there before your neighbor. For that's what the Greeks are learning today under Nazi domination!

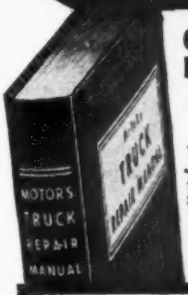
IF AMERICA WINS . . .

. . . there will be food for all—for only under democratic rule can the world hope to utilize the unlimited resources at its command.

And you can start planning *now* for the future you prefer by the number of War Bonds and Stamps you buy.

FREE 7-DAY OFFER!

Motor's New TRUCK REPAIR MANUAL



Gives Step-by-Step Instructions for Overhauling ALL TRUCKS —1936 to 1942!

JUST completed—the only book of its kind! Based on all the official truck manufacturers' manuals, and clarified for quick, ready use. Covers both diesel and gasoline engines—all models built from 1936 through 1942. Hundreds of pictures and diagrams. Complete charts and specification tables. Over 100,000 important facts you must know about tune-up and repair. Scores of helpful hints and ideas for replacing parts TODAY so that you can keep America's trucks ROLLING! Sturdy, waterproof binding; size 8¼ x 11 inches. Warranted to contain every single essential fact you need to do ANY job. Special Reference Index makes it easy to find the answer to anything at once.

Explains Every Repair Job on Every Model of all Trucks—1936 through 1942, Includes:

GASOLINE ENGINES

Autocar	Hercules
Buda	International
Chevrolet	Lycoming
Continental	Mack
Dodge	Reo
Ford	Studebaker
GMC	Waukesha
Hall-Scott	White—White Horse

DIESEL ENGINES

Buda	GMC
Cummins	Hercules
Dodge	Mack

Hesselman Engines Waukesha

DIESEL FUEL INJECTION SYSTEMS

American Bosch	Ex-Cell-O
Cummins	GMC
	Timken

FUEL SYSTEMS including Fuel Pumps, Carburetors, Carburetor Governors, Air Cleaners; **ELECTRIC SYSTEMS** including Distributors, Magnetos, Generators & Regulators, Starting Motors & Switches; **TRANSMISSIONS** covering all units from 2-speeds to 10-speeds, Clutches, Rear Axles, Torque Dividers, Transfer Cases, Universals; Brakes, Power Brakes, Air Brake Systems, Gears, Steering

ANYONE CAN USE IT!

Makes the ordinary mechanic an expert; helps the expert save time and money. Already being used by schools, U. S. Armed Forces, scores of fleet owners. Available only through MoToR Book Dept.

IMPORTANT NOTE TO FLEET OWNERS

Special discounts are offered for quantity purchases. If you decide to order in quantity now, we bill you later at discount prices. Same refund guarantee.

SEND NO MONEY!

Simply fill out coupon below. Mail it today and a copy of MoToR's up-to-the-minute New Truck Repair Manual will be sent to you at once for 7 days' Free Examination.

Published by MoToR, The Automotive Business Magazine, Desk T33, 572 Madison Ave., New York, N. Y.

FREE 7-DAY TRIAL

MoToR BOOK DEPT., Desk T33, 572 Madison Ave., New York, N.Y.

Rush me MoToR's New Truck Repair Manual. If O. K. I will remit $2 in 7 days, and $2 monthly for 3 months plus 35c shipping charge with final payment. ($8.35 in all.) Otherwise I will return book in 7 days. **(Foreign price $10, cash with order.)**

NAME_____ AGE_____

ADDRESS_____

CITY_____ STATE_____

OCCUPATION & EMPLOYER_____

☐ **SAVE 35c!** Check here if you enclose $8 (Foreign $10) with coupon. We then pay 35c costs. Same 7-day return privilege.

Goodbye To Blitz

[*Continued from page 57*]

Wars I and II, the tank underwent a transformation into an instrument of heavier armor, greater hitting power and higher speed. Instead of being a self propelled and armored machine gun platform, it became a self propelled and armored artillery platform. Tank enthusiasts foresaw the winning of battles by the tank alone. But the tank enthusiasts forgot two things. One of these is that infantry only temporarily, from time to time, loses its role as the final decisive arbiter of battle and the other is that artillery is inherently weak without infantry support.

The favorable circumstances in France and the Low Countries gave substance to the claims of tank proponents, for the German panzer divisions, used in mass against a demoralized enemy, were spectacularly effective in bringing swift victory to the Wehrmacht. The same situation existed in the initial stages of the German campaign against Russia.

But the stalemate was not long in coming. The Russian infantry improved its anti-tank weapons and technique to a remarkable degree. This was inevitable because basically the ancient factors pertaining to the respective roles of infantry, cavalry, and artillery, have always held true.

The great battles of this war have shown that nothing has as yet succeeded in replacing infantry, and infantry's role in battle. It is interesting to note that Germany has steadily increased its infantry in this war, having now a total of some 300 divisions, as compared to 240 divisions in the last war.

The Germans so far have shown themselves better copyists than originators. They copied the blueprints of tank warfare as they were set down by that brilliant and capable Britisher, Colonel J. F. C. Fuller. The Germans went no further. The anti-Axis nations have copied the Germans and have halted at the same point.

But today the Germans are revising their tank tactics.

The Germans in Russia today are using their tanks as movable artillery and machine gun pill boxes, supporting advancing infantry, with the tanks themselves protected by anti-tank and anti-aircraft artillery. In some cases reported in the communiques they even bury their tanks and make them into immovable pill boxes. This is a long step from the bold cavalry onset of their first use of the tanks. It is a step in the wrong direction. It forces the tank to conform to the present infantry lack of speed and mobility.

So far as our own armored divisions are concerned, we have not gone much beyond the initial German model, although we have increased our defensive power *against* armored divisions.

Our excellent hard hitting tank destroyer on a full track carriage, armed with a 90 mm. gun is already in action in Africa and such reports as

[*Continued on page 171*]

The School Shop

[*Continued from page 168*]

is set up between the blades which causes a loss of power. An increase in engine horsepower can compensate for this, however. The slope or "cut" of a blade is called the *pitch*. A *fixed pitch* prop is one in which the blades are permanently set. With the *variable pitch* prop the angle of the blades can be adjusted by the pilot while flying. A *constant speed* prop is controlled automatically by the engine. In *flat* or *low* pitch the prop is given a very slight slope. *High* pitch is just the opposite. When the blades are set straight ahead edgewise to the airflow past the plane, they are said to be *full-feathered*. We'll study these topics in detail in the lesson on propellers.

All of us are familiar with the *fuselage* of the plane. To it are attached the wings, empennage, powerplant and landing gear, and it holds the passengers, cargo, etc. It is not an airfoil, for every effort is made to keep it as streamlined as possible. It must provide good vision for the pilot, must be strong enough to take full lift and landing loads, and fuel lines, magnetos, ignition leads and instruments must be so arranged within it that inspection, repair and replacement can be easily accomplished.

As for the *landing gear*—the simplest type is that which has a straight axle with wheels at the ends and which is supported by struts and bracing wires. This type is now obsolete, however, and has been superseded by a split-axle type forming two independent parts. Mechanisms and methods of retracting landing gear of the single-strut type are many and varied. Most of them involve mechanically or hydraulically operated struts which fold the gear up into the plane and locking devices for the up and down positions. Tricycle gear add to stability in landings. Seaplanes make use of aluminum or plywood floats or pontoons, supported by struts and wires. The amphibian offers a more difficult problem for its wheels must be retracted directly into the hull of the ship and this necessitates a complicated system of gears and levers.

Our discussion would not be complete without mention of the biplane although it is rapidly becoming ancient history. Before the development of cantilever type wings, the biplane offered the advantage of maximum wing area and lift with a very short wing span. Later it was used for shipboard fighters which had to be stored in the smallest possible space on the aircraft carriers. Planes with folding wings and terrific speeds and without the wing interference and drag of the biplane are the newest models.

Questions on this lesson will be found on page 174.
(April MI—Lesson 3: What Makes It Fly?)

A part wool blanket should contain at least 25% wool to be noticeably warmer than an all-cotton blanket, says a home economist.

Goodbye To Blitz

[*Continued from page* 170]

have come through credit it with doing excellent service both at El Agheila and in Tunisia, while our 105 mm. destroyer mounted on what appears to be a cut down M-3 chassis can be assumed to be rendering even harder hitting service. American self propelled artillery, moved secretly up to the line on the eve of the attack against Rommel at El Alamein, is credited with having created devastation among Rommel's tanks at the first onslaught. Not believing that any guns could create such havoc, Rommel ordered a second attack against them, only to be repulsed with even greater losses in armor.

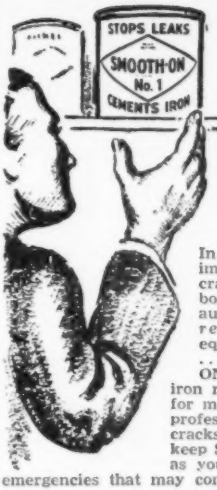
In his subsequent retreat Rommel, having no strong points in that desert terrain, had to resort to a lavish use of land mines—charges of TNT, buried and camouflaged, set to explode under the weight of a tank—to try to slow up the Eighth Army. These mines, thousands of them, had to be cleared away by British and Australian engineer troops before their tanks could advance. But despite these obstacles, the armored division in desert terrain is still capable of slashing attacks impossible to it in normal and more varied terrain. As desert areas will form a relatively small part of the total eventual fighting areas, we would be wise not to base too much of our armored tactics upon desert warfare considerations.

Eventually we will have the Germans on the defensive in Europe. This will entail the eventual hurling our armored divisions against successive lines of hedgehog defense, rendered practically invulnerable by high velocity anti-tank rifles, light anti-tank infantry cannon and heavier anti-tank field artillery. Granted that under terrific freezing winter weather conditions, the Russians can achieve some success against such obstacles with the present organization of their armored troops, it is highly doubtful whether our present organization, without some modification, can achieve like success under the more temperate weather conditions in which we would have to fight in other parts of Europe.

There is no question now that our armored divisions will rapidly achieve quantitative superiority to the Axis. Detroit is now reported to be turning out tanks, armored cars and other military vehicles sufficient to equip an entire armored division every 5 days.

Qualitatively we have achieved superiority, our light tank being superior in speed and equal in hitting power to the German Mark III while our 30 ton medium M-4's are superior in armor, speed and hitting power to the German 22 ton Mark IV. Said Major-General Levin H. Campbell, Jr., Chief of Ordnance, U. S. Army, speaking of the fighting in Egypt, "Our General Grants equipped with 90 mm. guns had devastating effect on the Nazis at 2,000 yards—700 yards farther than anything the Nazis had used."

[*Continued on page* 172]



WHY YOU SHOULD KEEP SMOOTH-ON HANDY

In wartime it's hard . . . often impossible for you to replace cracked or leaking furnaces, boilers, radiators, piping and automobile parts. But, you can *repair* household and auto equipment quickly . . . easily . . . lastingly . . . with SMOOTH-ON No. 1. This many-purpose iron repair cement has been used for more than forty-five years by professional repair men to fix cracks, leaks and loose parts. They keep SMOOTH-ON handy . . . just as you should do . . . ready for emergencies that may come at any time.

Anyone can make lasting repairs with SMOOTH-ON. All you do is mix SMOOTH-ON with a little water and apply like putty. No heat, no special tools, are required and you don't have to dismantle any parts.

A few cents worth of SMOOTH-ON will save you many hard earned dollars. Unused SMOOTH-ON does not deteriorate. You can keep it handy for years.

Get SMOOTH-ON in 1¼-oz., 7-oz., 1-lb. or 5-lb. container from your hardware store or from us.

FREE

40-Page Repair Handbook chock full of practical repair hints that will help you to keep household, car, and shop equipment in good condition and enable you to repair what you can't replace. Your copy sent free on request.

MAIL THE COUPON

Free

Smooth-On Manufacturing Co., Dept. 69
570 Communipaw Ave.,
Jersey City, N. J.

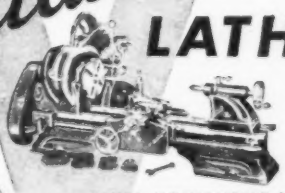
Name .....

Address .....

3-43 .....

Do it with SMOOTH-ON

Atlas LATHES



VITAL EQUIPMENT IN THE NATIONS' DRIVE FOR VICTORY

LATHES · DRILL PRESSES · ARBOR PRESSES · SHAPERS · MILLING MACHINES

Goodbye To Blitz

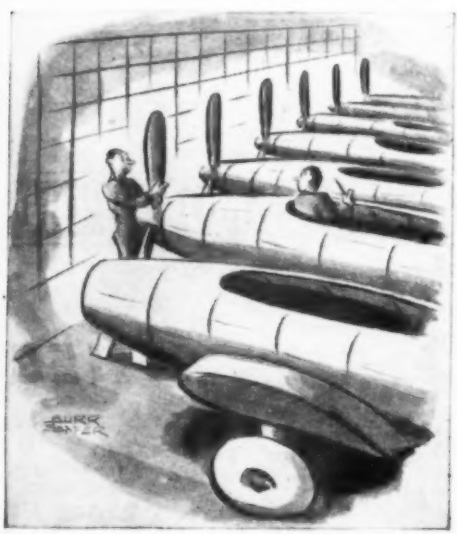
[*Continued from page* 171]

In other words, our armored divisions would undoubtedly win against the German armored divisions. Whether they would win against German hedgehog defenses without modification of their existing organizations and tactics is another matter.

That both British and Germans are modifying their tactics and organizations is evidenced by the reports of the British "Swan Groups"—compact groups of tanks, armored cars, self propelled artillery, and infantry used successfully at El Agheila against Rommel.

Similar organizations are doubtless being used by our forces, and will provide a partial answer to the overcoming of infantry defense by armored offense. But they will not provide the entire answer. There is an answer, however, which can not be gone into here, but which is already in the hands of our military authorities and may provide the missing factor that will take the tank out of the temporary twilight to which it has been relegated recently. All in all, we can depend upon American ingenuity and skill to put the Blitz back into the Blitzkrieg and astonish and discomfit the Nazis in doing it.

Small-flake mica, essential to the manufacture of electrical equipment for the armed forces, can be quickly sorted with a new process of electrostatic grading. Powdered mica is subjected to charges from a grid electrode, attracting the thinner particles and leaving the heavier ones.



"I've been curious about this ever since I've been here. What do we put these fans on the front of each plane for?"

The Swingaroo

[*Continued from page* 124]

of soft white pine or other wood, provide sawing clearance for a length of 12 7/16", a 4¼" width and 2 7/16" height.

Band saw or rough-out the hull to proper side and top views. Cut templates from cardboard to the curvature shown. Shape the boat, using a drawknife, plane, pocket knife, file, and sandpaper. An electric sanding disk is excellent for such shaping. Finish off the surface with progressively finer grades of sandpaper. Glue in place and shape the cylinder bank covers, air scoops, and fin.

Fill the surface well before painting. Apply two to four coats of paint in any trim you desire. The original has a flaming red nose and bottom, and the remainder painted white. A Walt Disney insignia in a red circle completes the trim.

Rig the model by inserting two eye bolts in the portside (left side looking from rear toward front). Attach a one foot length of cord between the two eyes. To the middle of this short piece tie the long cord, the length of which, added to the length of the pole, should equal about 25 feet.

This boat makes a fine display model when it isn't burning up the race course. Better build one.

And when you go to the beach or the swimming pool the next time you will probably find a number of modellers who've never seen a *Swingaroo* before, but who'd like to build one and give you a race.

Power Hacksaw

[*Continued from page* 132]

to have it square with the base, so it will make a vertical cut. The saw blade works a bit smoother when placed to cut on the pull stroke; but it can be turned end-for-end to distribute wear over all of the teeth.

The vise shown is a rugged type designed for drill-press use, but any similar vise may be used. The blade should clear it by ¼" to ½" and the jaws should hold the work at right angles to the blade. It would be worth the extra trouble to mount the vise so it can be rotated for angle cuts, and moved back and forth so wear may be distributed evenly along the teeth of the saw without reversing the blade.

If the bearings are reasonably snug and kept well-oiled, the gears lubricated with a suitable grease, and the grooves in which the blade arm slides do not permit too much play, the saw will operate with surprising quietness. The motor may be mounted in any convenient position and connected to the saw by a short V-belt.

Industrial gas masks protect the wearer against carbon monoxide and other insidious, odorless gases for about two hours at a time. Then a luminous dial warns the worker that the filter has been exhausted and needs a refill.

Soldier Of Science

[*Continued from page* 61]

result, and found he'd produced something very similar to natural crude rubber.

Semon and his men tested the new kind of rubber in a thousand ways. They found it vulcanized like natural rubber. They found it wears as long as natural rubber—and resists sun, aging, and heat much better.

They made tires of it. You may have seen some in display windows or in actual use. These tires have proved themselves better than the best ones of natural rubber. They cost a little more, but they're probably worth it anytime; and they're certainly worth their cost to a nation with a mechanized war to win, a war that must be fought on rubber.

And best of all, this new and better rubber is made of products to be found in abundance in America. It, like Koroseal, depends not at all on hazardous voyages to the Orient. Indeed, it is made in large part from a petroleum product; the same process that gives you the gasoline to propel your car can help make the rubber it rolls on.

A practical synthetic rubber means as much to America's war effort as the launching of a whole fleet of battleships—but the tradition that prescribes a champagne christening for a ship makes no provision for the ceremony of naming a scientific discovery. So they just said, "We'll call it Ameripol," and let it go at that. (The name, by the way, is as true a synthetic as the product; it was formed by joining part of "America" to a syllable from "polymerize.") Some folks prefer to call it "liberty rubber"—and that's a pretty good name for it, too.

Safety engineers are salvaging invaluable quantities of illumination in war plants by finishing floors, walls, ceilings and machinery in bright paint colors that reflect rather than absorb light. The improved seeing conditions reduce accidents, and the contrasting color schemes used create far more cheerful settings in which to work. Factory interiors of tomorrow, it is said, will be as gay and bright as they have been dingy.

HELP YOURSELF GET THE JOB YOU WANT IN THE ARMY!

PASS HIGH ON THE INDUCTION "I.Q." TEST

Everyone entering the Service must take a General Classification "Intelligence" Test. A high mark on this test helps you toward the JOB YOU WANT and OFFICER TRAINING.

"PRACTICE FOR THE ARMY TESTS"

is a book containing complete and simplified material along the lines of the questions given on the test . . . tells how to answer them quickly, easily—costs only $1.50. Get a thorough preparation RIGHT AWAY if you're about to enter the Service.

Free Trial Coupon

ARCO PUBLISHING CO., 480 Lexington Ave. Dept. 2703, New York, N. Y.

Please rush copy of "Practice for the Army Tests" to me. If I am not satisfied after 5 days, I will return book for a full refund.

☐ I will pay postman $1.50 plus postage, on arrival.
☐ I enclose $1.50 (Postage is free)
☐ Send me special bound deluxe edition. I will pay postman $2.50 plus postage.

NAME .....

ADDRESS .....

CITY..... STATE.....

EVERYTHING IN RADIO!

FOR REPLACEMENT PARTS AND HELPFUL RADIO BOOKS
Send Your Orders To Allied

NEW—Allied's Radio Formula and Data Book—10c

ALLIED RADIO CORP.
833 W. Jackson Blvd., Dept. 6-C-3, Chicago, Illinois

★ ALLIED RADIO ★

5 DAYS Free inspection

ARC WELDING!

516 Pages, 512 Illustrations. A New DAILY GUIDE for operators and managers doing vital war work. Explains NEWEST TECHNIQUES, METHODS, PROCEDURES and MATERIALS. With charts, diagrams, tables to show you best methods for metals and positions involved.

$2.00 POSTPAID

Order Your Copies at Once!

This Complete and Authoritative book

ANSWERS your every welding question. You'll actually use it as a daily guide because it's chucked full of valuable last minute welding information. It'll put you straight, in words and pictures, on EVERY welding operation.

192 pages of Arc Welding Lessons

This one section is a gold-mine within itself. Shows student correct methods of present day applications. Brings the expert up-to-date. You can't afford to waste a day, so get your copy NOW!

HOBART Bros., Box SM-33, Troy, Ohio

"One of the World's Largest Builders of Arc Welders"

The Post-War Radio

[*Continued from page* 50]

pulling out a drawer, you find it packed with tight rolls very much like amateur movie film in appearance.

Thread one of these rolls into carriers that pull it past photo-electric cells, and beautiful sounds (assuming that you have chosen a musical reel) fill the room. You have guessed that the film contains sound tracks, like those on professional movie film, and that the music is electrically reproduced. But these tracks are so small that you can put a hundred of them side by side on a narrow tape, and that tiny roll will play its consecutive tunes for as long as twenty hours without a break.

There is no record changing every four or five minutes. There are no bulky records to store, to break or to get scratched. And since there is no needle, there naturally is no needle scratch. Theoretically, your sound track will last forever since light does not wear it out. In practice, there is wear involved by the mechanical necessity of reeling and unreeling the tape, but this is relatively slight.

You will have to be careful not to scratch the film or get it dirty, for a dust speck might sound like a 16-inch gun. Electrostatic cleaning devices built into the cabinet will minimize this possibility, cleaning the film as it travels, and your post-war home will be practically dust-free anyhow (see MECHANIX ILLUSTRATED, November, 1942). It will not be easy to scratch the film, for it will be protected by a resistant transparent coating. The Agfa Company has already developed a sound track on cellulose tape.

Is letter-writing a bore to you? Let your electronic cabinet write your letters for you. It will record sound as well as reproduce it. Just speak your message into a microphone and your words are recorded magnetically on a tiny metal tape. Mail this to your correspondent (an ounce of tape will carry many more words than an ounce of writing paper) and after he has "read" your message in his own reproducer he can demagnetize the wire and use the same tape to write you an answer in his own machine. This recording principle has been elaborately developed by the Bell Telephone Laboratories.

Lovers of the printed page may be shocked by the idea of a "library" of classics and best-sellers made up of row upon row of film-filled metal spools. But these books will have a special appeal because your radio will read them for you. It is not quite accurate to call them books. They are a brand-new form of entertainment—part book, part movies, part radio.

Already, thousands of American soldiers are receiving "V-Letters" written on microfilm. The original hand-written letter is photographed on extremely fine-grain film, coming down to about one-quarter the size of a postage stamp. At the receiving end the film negative is enlarged to the

[*Continued on page* 175]

"Priority Wheel"

[*Continued from page* 119]

wood. Sidewall edges or rims are beveled, but in spite of inevitable wear the wire tire prevents the wood being ground down sufficiently to permit wires to slip off.

A roller bearing is made as shown, with eleven rollers cut from 3/16" drill rod or bolts, the ends pointed and retained by a flange welded to the half-inch axle at one end and a washer at the other. These rollers turn in a short length (available in a bicycle shop scrap heap) of steel tubing, 7/8" inside diameter. A straight bearing can be made of brass tubing just large enough to fit over the axle. But do not use a steel axle in steel tubing without rollers.

Steel tires on well-balanced wheels permit speed on sidewalls, and these tires can be renewed when worn thin.—*Hi Sibley.*

Mils vs. Degrees

[*Continued from page* 136]

As a matter of technical information, it might be stated that a true "mil" is the angle subtended by an arc of one unit on a radius of 1,000 units. Recall from your high school "math" that simplest of all formulas: the circumference of a circle equals 3.14159 ("pi") times the diameter, or twice "pi" (6.28318) times the radius. A full circle therefore contains 6.28318 times 1000, or 6283.18 mils. Since this number does not lend itself to rational subdivision of the circle, the United States Army has adopted the arbitrary value expressed by one sixty-four hundredths of the circle. Fractional parts of a mil are expressed as decimal parts of a mil, although in practical work such fine subdivision is rarely necessary.

Students' Question Box

When you have finished Aviation Lesson 2 in the School Shop section, and think you know it backwards and forwards, test yourself with these questions. Let's make 100% passing. Answers are in the text.

1. *What is an airfoil?*
2. *How is aspect ratio measured?*
3. *What is the difference between dihedral and sweepback?*
4. *What is a Fowler flap? A split flap?*
5. *What is the purpose of a flap?*
6. *What is a cantilever type wing? Its advantage over other types?*
7. *Explain the term "empennage."*
8. *What is meant by the expression "trimming a ship"?*
9. *What is a tab? How is a metal rudder tab adjusted?*
10. *What is a balanced control surface? Its purpose?*
11. *State the relative merits of liquid-cooled and air-cooled engines.*
12. *What is pitch? State the difference between fixed pitch, variable pitch and constant speed props.*
13. *When is a prop full-feathered?*
14. *Name two types of landing gear used on modern aircraft.*
15. *State one disadvantage of the biplane.*

The Post-War Radio

[*Continued from page* 174]

size of the original letter. Such microfilm is also used by libraries to photograph rare volumes too precious to be entrusted to the public; instead, the pages are projected from the film upon a screen, where the reader scans them.

So one of these days you'll have a lightweight screen, the size of an average book page, which you can hold in one hand. Slip in a roll containing the current best-seller, flip a switch that turns on a tiny but powerful lamp, and you read page after page, perfectly illuminated and easy on the eyes. Illustrations, in black and white or in full color, are reproduced with a needle-sharp clarity beyond the ability of even the finest halftones. Your "book" will be much cheaper than a printed volume, for costly binding operations are eliminated, and the printing process on film (since each page is smaller than your little finger nail) much cheaper than running sheets of paper through giant presses.

But that's only the beginning. There is no reason why your book film can't contain a sound track as well, with your electronic cabinet aching to reproduce it. Then you not only read the words on a screen, but you hear the scream of the heroine as her golden locks near the buzz saw—the "Curse you, Jack Dalton!" of the villain run to bay by the hero.

These sound accompaniments may be provided by your favorite actors. In fact, they may act out the entire book, so you needn't read it in the ordinary sense. Even descriptions of scenery will be welcomed when the narrator speaks the author's words against a lifelike picture of mountain sunset or rolling breakers on a shore.

There's no name yet for this new art-form. But you can see the possibilities, as soon as millions of homes acquire the versatile electronic cabinets we're talking about. A best-seller that costs no more than a ticket to the movies, that tucks away in a space no larger than a cigarette case, that puts Clark Gable or Greer Garson or Lionel Barrymore to work entertaining you the instant you touch a switch—here's a new thrill added to that justly appreciated custom of curling up with a good book.

If all these wonders seem too much for that small cabinet to deliver, it's because you don't fully appreciate the marvels of electronics. But don't feel guilty. Researches in this field are so secret, so intimately bound up with the war effort, that few persons outside the laboratories really know what's going on.

It is safe to anticipate, however, that a radio set containing only six tubes will reproduce sound better than costly sets that now have 30 or more tubes. Engineers know how to build tubes, at slightly higher cost, that will last for 20 years—the lifetime of a set, for all practical purposes; so they may be built permanently into the cabinet.

Of course there will still be radio sets that re-

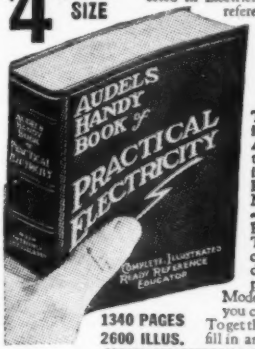
[*Continued on page* 176]

KEY TO A PRACTICAL UNDERSTANDING OF ELECTRICITY

$1 PER MO.

● AUDELS HANDY BOOK OF ELECTRICITY

$4 HANDY SIZE



1340 PAGES
2600 ILLUS.

For Engineers, Electricians, Students and all interested in Electricity. A quick, simplified, ready reference, giving complete instruction and practical information. Easy to understand. A reliable authority and a handy helper that answers your questions.

● INSIDE TRADE INFORMATION ON

The Rules and Laws of Electricity–Maintenance of Machinery–A. C. and D. C. Motors–Armature Winding and Repair–Wiring Diagrams–House Lighting–Power Wiring–Cable Splicing–Meters–Batteries–Transformers–Elevators–Electric Cranes–Railways–Bells–Sign Flashers–Telephone–Ignition–Radio Principles–Refrigeration–Air Conditioning–Oil Burners–Air Compressors–Welding, and many Modern Applications explained so you can understand.

To get this assistance for yourself, simply fill in and mail the FREE COUPON below.

READ FOR PROFIT!

THEO. AUDEL & CO., 49 West 23rd Street, New York

Please send me "Audels Handy Book of Practical Electricity" for free examination. If satisfactory, I will send you $1 in 7 days, then $1 monthly until $4 is paid. Otherwise I will return it.

Name_____

Address_____

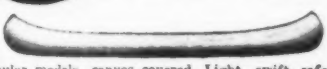
Occupation_____

Reference_____ MM

Thompson BEATS the World on BOATS

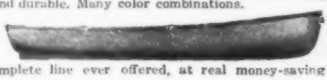
Better Built Lower Prices

Canoes $75 and up



All popular models, canvas covered. Light, swift, safe, strong and durable. Many color combinations.

Rowboats $48 and up



Most complete line ever offered, at real money-saving prices.

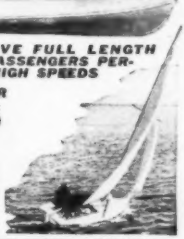
Outboard Boats $48 and up

THOMPSON BOATS HAVE FULL LENGTH SPRAY RAILS. KEEP PASSENGERS PERFECTLY DRY AT HIGH SPEEDS

SEVEN MOST POPULAR

SAIL BOATS

12 ft. OLYMPIC	$160
15½ ft. SNIPE	$230
16 ft. COMET	$305
17 ft. NATIONAL	$350
18 ft. SEA GULL	$475
19 ft. LIGHTNING	$535
21 ft. RED HEAD	$675



These boats are complete, with sail, mast and rigging at prices quoted above.

CATALOG FREE—SAVE MONEY—PROMPT SHIPMENT

Please state the kind of boat you are interested in (112)

→TWO LARGE FACTORIES←

THOMPSON BROS. BOAT MFG. CO.

230 Ann St. PESHTIGO, WIS. [*Write to Either Place*] 130 Elm St. CORTLAND, N. Y.

The Post-War Radio

[*Continued from page* 175]

ceive sound broadcasts and nothing more. It all depends on how many of the accessories we have described you are willing to pay for. Be assured that there are few, if any, technical obstacles remaining in the way of these developments.

You camera fans who swear that photography is the king of hobbies are in for some pleasant surprises, too. As graininess is more and more eliminated, as in microfilm, you'll be able to shoot a hundred negatives on a foot of narrow film. Shoot scenes by the dozen at trifling cost, and enlarge the best one to the size of murals if you wish.

Focusing and adjustment of exposure to different light conditions—tedious and difficult at best, even with the aid of light meters—will in time be eliminated by compact attachments that take care of these details automatically. Candid cameras will become much smaller than those we are accustomed to, since the raw film roll will be unbelievably tiny. In fact, some cameras will be so small that they can be mounted over one lens of a pair of spectacles, controlled by a remote release—press a button in your pocket and you have a perfectly exposed negative of whatever scene your eyes take in.

Anyone who has priced a candid camera with a fast lens, such as an f/2., knows that they run into impressive money. The good news here is that, by various means, the cost of such lenses is going to be reduced and efficiency increased.

One possible method is that of a Boston inventor, Frederick J. Binda, who has patented a method of making lenses cheaply out of plastics. These are poured into moulds rather than tediously ground. An objection to plastic lenses is that they are easily scratched, but this is overcome by depositing a very thin coating of glass upon the plastic.

Even the best lenses are slowed up by loss of light reflected from their surfaces. This loss of light is considerable in the best lenses, made up of several elements. A new process developed in the R. C. A. laboratories makes it possible to deposit a film of calcium fluoride, only one-fourth the thickness of a light wave, upon glass surfaces. This unimaginably thin coating almost eliminates the 5% loss of light caused by reflection at the surface of ordinary glass.

The result is that your camera lenses, so treated, will greatly step up the contrast and brilliance of the image, and will reduce "ghost" images as well. The speed of your lens will be increased, so that at full diaphragm opening an f/3.5 lens will be as fast, perhaps, as an f/2. On movie projectors such lenses will give brighter screen illumination and sharper pictures.

With an efficient means of sound track recording available in your new electronic cabinet, the whole fascinating hobby of amateur movie-making will at once leap into the professional class.

[*Continued on page* 177]

Adapt Radio For Recording

[*Continued from page* 143]

the "Radio" position. Cut one of the wires from the output transformer of the set to the voice coil of the speaker and connect the other two wire cables to the two loose leads that result as indicated in the block diagram. These wires also will be re-connected when you turn to the "Radio" position. The other lead between speaker and output transformer is connected to the chassis of the set to complete the circuit.

In order to insure that you are always recording at proper volume, an output indicator is incorporated. This indicator consists of two G-E NE-7 neon bulbs connected so that one will continually glow at proper volume and the other only on peaks. Occasional flickering of the "overload" indicator is permissible, but if it glows constantly or frequently, the volume should be lowered or the recording will be distorted.

Any crystal microphone is suitable for use with this adapter. The built-in preamplifier makes it possible to use the full volume of the radio as a public-address system. In recording through the mike, the output indicator system is used in the same manner as outlined above.

Matching the output of the set to the crystal cutter (for recording) is adjusted in the transformer T. The transformer used in the original unit was a Thordarson type T13S38, but any output transformer with a 10,000 ohm primary and a tapped secondary can be used. Note that the transformer is connected *backwards*. The primary is connected to the cutter and the secondary is connected to the output of the set. It is necessary to select the proper taps on the transformer secondary to match the voice coil of the speaker. If your set has a 4.5 ohm voice coil, for example, connect the wires to the terminals of the transformer that give a 4.5 ohm match as indicated on the specification sheet which came with the transformer.

Note that the two cables from the adapters are led through the chassis as far apart as space will permit. At all times keep these output and input cables apart to prevent feedback.

If your receiver is of the "ac-dc" type, it will be necessary to use a 12SQ7 tube rather than a 6SQ7 in the adapted unit; and the filament of this tube will have to be wired in series with the tube filaments in the receiver. In doing this, it may be necessary to remove the "ballast tube" if there is one, or removing or changing the value of the "voltage-dropping resistor" in the series filament circuit. Moreover, in using the adapter in this way, the adapter chassis will be "hot" and should be placed where it cannot be accidentally touched.

"We are now in the 1960's of motor cars as measured by the old pace of development," said Dr. Charles M. A. Stine, a vice president and research advisor of the Du Pont Company before the American Chemical Society.

The Post-War Radio

[*Continued from page 176*]

You'll be able to make sound-on-film movies that are as easily spliced and edited as present soundless types. Amazingly lifelike sound reproduction is assured by the electronic phonograph section of your cabinet.

New competition from electronic books, television, and rental films of professional quality will force theaters to adopt improvements, too. We've already seen one trend in Walt Disney's newly patented method of sound reproduction that places built-in loudspeakers in the walls, ceilings, and other areas of a theater. Mickey Mouse will squeak right in your ear instead of behind a movie screen, and you can follow the yelping of Pluto the Pup from one side of the theater to the other.

A fully perfected invention in which David Wark Griffith is interested will, he believes, improve the movies 100%. Mr. Griffith calls it a "broad angle film," and declares it will not only give the same effect of depth you get on a stage, but eliminate the annoying distortion observed on present screens when you sit at the extreme sides of the theater.

It's any man's guess what other wonders you'll have in the home in the way of toys, games, and sports, but it is certain that many of the developments we have suggested will be applied in striking ways. For instance, Johnny will probably fly his model airplanes in the game room, controlling their acrobatics by radio. You can visualize a toy submarine, similarly controlled, diving and firing torpedoes in the bathtub. You can imagine a piano with sound effects amplified by electronic circuits, or given novel effects, or playing difficult music for hours at a stretch through sound track controls, or illuminating the proper keys in sequence to make it possible for anyone to learn to play the instrument quickly. The whole field is as big as all outdoors for inventors, with handsome financial rewards in prospect.

Not overnight, but beginning in a hurry when the war ends, you're going to see these things add new pleasures to your daily life. We can't buy them now—the discoveries that make them possible are being applied to the manufacture of disastrous surprises for the Axis. But we can begin to buy them through War Savings Bonds. That stamp you buy today you can spend tomorrow to bring the moon from Tahiti!

Chief advantage of rayon in tires is that heat does not sap its strength as it does that of cotton. Rayon cord tires average to run 15 per cent cooler than other tires. Because the rayon cord tire carcass lasts longer, it can economically take a thicker tread and can also be re-treaded more times. Rayon in tires is by no means "experimental"—Du Pont "Cordura" high-tenacity rayon was thoroughly tested, approved and used in thousands of heavy-duty tires in peacetime. It has been in production since 1936.

AQUELLA STOPS SEEPAGE of WATER!

Now you can STOP MOISTURE, ..DAMPNESS, and WATER-INFILTRATION in the Walls of your Home

...with Aquella, the New Waterproofing Paint! Prevents Costly Repairs

AQUELLA applied to concrete walls of basements and brick walls of houses subject to water infiltration, dampness or moisture, due to rain or other causes, renders them WATERPROOF . . . becomes a permanent part of the wall surface. The surface to which AQUELLA has been applied is smooth and uniform. NO BLISTERING! NO PEELING! NO FLAKING! The wall can be washed repeatedly and will become harder with each washing. This new special paint also seals walls of tunnels, mines, underground worksheps and storerooms, etc., as well as walls subject to steam, fumes or high humidity. AQUELLA is a white powder simply prepared by diluting with water and can be applied by anyone. Color is easily added. DON'T DELAY! ORDER TODAY! Your trial package for ½ gallon (about 4 lbs.) of AQUELLA sufficient to cover a good sized wall.

MODERN WATERPROOFING PAINT CO., Dept. MI-1
1270 Sixth Avenue, Rockefeller Center, New York, N. Y.

Please send me a trial package of Aquella for $1.25 plus postage. C. O. D. Please print.

Name _____

Address _____

City _____ State _____

BUY UNITED STATES BONDS AND STAMPS

Print Your Own

Cards, Stationery, Advertising, labels, circulars, photo and movie titles, church work, tags, etc. Save money. Sold direct from factory only. Junior outfit $8, Senior outfits $17.38 up. Do popular raised printing and embossing too. **Print for Others, Good Profit** Have a home print shop. Easy rules sent. Write for free catalog of outfits and all details. Kelsey, Inc., Z-9, Meriden, Connecticut

Build This Scale Model JEEP

Overall Length 9¾"

Here's the model of the hour! An authentic 1" to 1' scale replica of the U. S. Army Jeep. There's nothing more fascinating to assemble; nothing you'll be more proud to display. No special tools necessary. Kit contains everything—Full size, step-by-step plan. *Completely Finished* wood parts. Detailed printed parts in Color. Five finished scale wheels. Glue, Paint, Etc. Get your Jeep Kit today. Send check or money order to . . .

$1.25 Post Paid

H. F. AULER CO., MILWAUKEE, WISCONSIN

Exploring Life

[*Continued from page* 45]

red blood cells multiply in the same abnormal way. These excess corpuscles, like tumor cells, are the result of an abnormal speed-up in production at their source, the bone marrow.

As the magician's broom, in the tale of "The Sorcerer's Apprentice," carried in so much water the house was flooded, and would not stop without the magic word, so leukemia and polycythemia set bone marrow to work. And doctors could not find an effective formula for "Stop!"

Drugs, bleeding, x-rays and radium have been tried. The last two treatments were sometimes helpful in slowing down the abnormal cell growth —up to a certain point, then these radiations lost their power to control the diseases.

The possibility of treating leukemia and polycythemia with cylotron-produced radiation was an early hope of Dr. John Lawrence. Patients were given small oral doses of radioactive phosphorus in the form of sodium phosphate, which, following the usual course of phosphorus, went directly to bone marrow. The short-range, intense radiation of the charged phosphorus bombarded the abnormal corpuscles, and so slowed down the over-production of red or white cells that the blood count in many cases became normal. After two years, there have been no ill effects from the artificial radiation, and whenever abnormal cell count begins to rise, new doses of radioactive phosphorus continue to be effective.

Patients who had an excessive red blood cell count of 7,000,000 per cu. mm. had the normal count of 4,500,000 restored with radioactive phosphorus. This success is only possible when the diseases have not progressed far. Severe or acute cases are not helped. Although the new radiations cannot yet be called a cure, they are an improved method of treating these diseases. Present successes are only a preparation, for much must be learned and many more cases must be treated before an accurate evaluation of these treatments can be made. The limited facilities for producing radioactive phosphorus make it possible to treat only a few people at one time. Many more cyclotrons must be built to supply treatment for all who need it.

Although elements made radioactive by the cyclotron emit radiations similar to those of natural radium, there is one important difference between natural and artificial radioactivity; the synthetic variety is short-lived. Radiations given off in all radioactive substances gradually become weaker as the charged atoms lose their "fire."

Radium, a naturally radioactive element, will have lost half its activity in 1,690 years. This period is called the "half life" of activity and is a measure of potency. Elements made artificially radioactive in the cyclotron have much shorter half lives, ranging from oxygen with a half life of 2½ minutes, to sodium's three years.

This short activity is a distinct advantage in

[*Continued on page* 179]

Dual Record Player

[*Continued from page* 145]

shown in Fig. 1, so that the motors can be controlled individually. When the record being played on one turntable is about completed the second turntable is started up, the pickup placed on the record at the proper moment and the fader arm rotated. The first motor is then stopped and the next record in the sequence placed on the turntable, ready for the next switch and fade.

The Centralab MT-144 fader is recommended for this equipment. It costs only slightly more than a good volume control, and can be purchased in most any radio store.

An excellent portable case (Fig. 2) for a dual turntable unit of this sort is the Allied No. 93-606, made just for this purpose. It contains the motor board and measures 36½"x12¾"x9". These measurements may be followed in the construction of a housing of wood, with or without a hinged lid, and with a motorboard layout as shown in the detail sketch of Fig. 2. However, the case is so simple in design that it is suggested as a better procedure that the measurements be decided after the pickups and turntables are obtained; for if the pickups have short tone arms and the motor-turntables are no more than 9 or 10 inches in diameter, the case can have much smaller dimensions.

Turned Walnut Lamp

[*Continued from page* 151]

the base, and is cut roughly to shape on the bandsaw, or by hand with a scroll saw. The rough disc is then glued to wastestock, mounted in the lathe and turned to finished shape. A hole is then turned out to within 3/16-in. of the bottom for the standard tenon. The bottom of this hole is enlarged (see photo) and molten lead poured in for ballast. Another 5/16-in. hole must be bored on an angle from side to center to lead the cord through. The lamp is wired as shown in the come-apart photo, with a short nipple securing the socket in the standard.

Finish may be either shellac or clear lacquer, well rubbed. Three coats of shellac or two of lacquer is about right; shellac can be brushed on but lacquer is best sprayed. Use filler and stain on either walnut or mahogany before applying finish—maple needs no filler, though it may be stained, if desired. If a "blond" finish is preferred a commercial bleach should be applied to the wood as the preliminary step.

Glass has found greater use as a chemical engineering material since glass makers found ways of making shapes and weights of single glass pieces supposed to be impossible.

Germany is reported to be using zinc to replace aluminum in making slide fasteners.

Exploring Life

[*Continued from page* 178]

biological studies and treatments as there is less danger of destruction of normal cells by the exploding atoms, and the elements are soon passed from the body in normal excretions.

Doctors are not the only researchers to use radioactive elements. Botanists, zoologists, veterinary scientists, and entomologists are busy in their own fields, seeking answers to their particular problems by the light of radioactive tracers.

Studies affecting human nutrition and health have taken a particularly practical turn. Tracer experiments have shown that it is possible to improve the mineral and vitamin content of milk by feeding more substances rich in these essentials to the cow. Ten grains of iron fed to a cow every day, researchers found, will add enough iron to each quart of her milk to fill the total daily requirements of a growing child.

In the same way the vitamin and mineral content of eggs and meat can be increased by using fortified poultry and cattle foods. These vital elements can be given to animals much more cheaply and easily than the highly purified concentrates for human use.

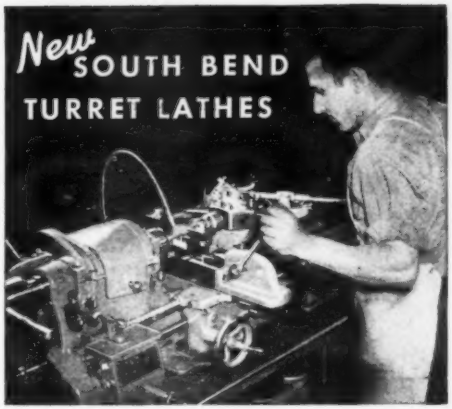
All animal life depends on the ability of plants to take air, soil and water and produce proteins, carbohydrates, minerals, vitamins and other food substances. Scientists call the process photosynthesis, and had many theories to explain it. Dr. Samuel Ruben and Dr. M. D. Kamen of the University of California traced radioactive carbon in carbon dioxide "breathed" from air surrounding test plants, and upset some of the textbook theories. Instead of appearing in an intermediary chemical, formaldehyde, as was formerly believed, the tagged carbon was found in another plant chemical which has not been named.

Scientists used to believe that all the stages of photosynthesis were carried on in the light, but Ruben and Kamen discovered, with radioactive carbon tracers, that instead of shutting down their chemical factory when the sun goes down, plants continue some phases of their food-making work during the night.

The radioactive research of entomologists will some day greatly increase the health and wealth of humans, for insects are perhaps our most formidable enemy. Pests, varying in size from giant grasshoppers to mites, sabotage hundreds of millions of dollars worth of supplies every year. They destroy 300 million dollars worth of stored grain annually in the United States, plus vegetables, fruits, forest trees and garden plants worth many hundred millions more. In fact, insects cause more damage to farm crops than drought, temperature extremes and all other plagues combined. In our homes moths and termites destroy an annual 60 million dollars worth of clothing and shelter.

Such is the damage of insects to wealth. But the health-toll of insects is even more startling, for they are responsible, principally as carriers, for

[*Continued on page* 180]



The new South Bend Turret Lathes are stepping up production in hundreds of war industries. They have the speed and accuracy for the rapid production of precision parts. Their versatility and time-saving features make them especially adaptable to second operation work. For complete information, write for Series 1000 Bulletins.

SOUTH BEND LATHE WORKS
South Bend, Indiana
Lathe Builders for 35 Years

Newest and Largest in Baltimore
Moderate Rates
LORD BALTIMORE HOTEL
BALTIMORE, MARYLAND

AVIATION
DRAFTSMEN NEEDED by makers of planes, motors, equipment. Good pay. Special *Aviation Drafting* course trains you QUICKLY at home in spare time. FREE Bulletin. No obligation. Address **American School, Dept. A328, Drexel at 58th, Chicago**

BIG MONEY BUILDING MEAD'S
New Portable OUTBOARD BOAT

IN A FEW DAYS AT HOME! Build this light 50 lb. tough, durable, seaworthy, Portable Outboard Ki-Yak! Take it anywhere by hand or car. Safe, dependable, trouble free. More speed per horsepower, more miles per gallon. MEAD'S perfected Metal-ribbed, cut-to-fit construction Kit guarantees successful assembly quickly, easily, economically. New 69 lb. OK-4 uses oars, sail, motors, 9 h.p. or less. Also 3 "CK" paddle-sail models from 20 lbs. to 45 lbs. Double Paddle or Oars INCLUDED with your Ki-Yak! Write for FREE lavishly-illustrated circulars, low Factory-to-You-Prices!
Write for FREE Circular
MEAD GLIDERS, 15 S. Market St., Dept. M-33 Chicago, U. S. A.

Exploring Life

[*Continued from page* 179]

many of the diseases that plague mankind. Malaria, yellow fever and some varieties of sleeping sickness are spread by mosquitoes, body lice carry the germs of typhus from one human to another, spotted fever may be in the bite of many ticks, and bubonic plague, scourge of mankind since the beginning of history and appearing from time to time in present-day America, is spread by fleas. These are just a few of the diseases carried by insects.

The battle against these pests has proceeded on trial and error methods, with sprays and parasitic control as the usual weapons. Because insects are so small and have their own peculiar physiological laws, many questions of insect life have remained unanswered. With radioactive elements as tracers, however, new avenues ot research have been opened that may give men the upper hand in the heretofore nip and tuck struggle with insects.

Official reports are just being prepared by entomologists engaged in this research, but it is probable that an accurate analysis of the value of insecticides will result, leading to more effective control of pests and disease-carrying insects.

The entire story of the cyclotron and the miracles it makes possible is based on the autonomous atom. Atoms, the basic units of all matter, contain in their nuclei two kinds of "building blocks," protons and neutrons. For example, if each of the nuclei of a group of atoms has two protons and two neutrons, they make up helium, the light-weight gas used in balloons. The number of *protons* in the nucleus determines the kind of element the atom makes—gold, carbon, sodium. The number of *neutrons* determines the element's atomic weight and stability.

Scientists knew that if they could break into atoms and change the number of protons and neutrons, they could create different substances at will. That is, if they could remove three *protons* from the nucleus of a lead atom, the lead would be changed to gold. If they could add extra *neutrons* to sodium atoms, the substance would remain sodium, but would suddenly become radioactive, emitting penetrating alpha, beta and gamma rays similar to those from X-rays or radium.

The cyclotron has been able to make this atom-changing dream come true.

Resembling a huge, circular washing machine with a high-powered magnet as agitator, the largest cyclotron in the world, at the University ot California, home of the original invention, weighs 225 tons. The nuclei of helium atoms, called deuterons, are freed by a volley of electrons, and are poured into the inside chamber of the cyclotron. These deuterons spin faster and faster around the circular floor, their speed rapidly increased by the magnet's pull. When the deuterons attain a speed of about 60,000 miles per second, they are ejected through a tube in a beam with an energy of 25,000,000 electron volts. Atoms of any substance put in the path of this devastating

[*Continued on page* 182]

Lengthen Your Boat

[*Continued from page* 149]

As the short, cross-wise planks are put on, lay flannel strips soaked in white lead between the seams. The side planking might well have been similarly caulked. When the planking work is completed, all seams are filled with a mixture of white lead and putty, applied with a putty knife. Force the mixture well into the seams.

Regardless of the make-up of the foredeck or cabin top, the new after-deck might well be of ⅜" plywood. This is cut to size and fastened around the edges to the deck chine, transom and cockpit stringer; and also every six inches to the deck beams. Use ¾" flat-head screws and conceal their head with white lead.

The coaming of the new cockpit should taper aft, with the fore ends flush with the cabin top. A ½" quarter round goes outside the coaming at the intersection of the deck. Cap the top edges of the coaming with an oval-shaped ⅜" by ¾" trim, fastened with screws.

The old outboard rudder, attached to the transom, is permanently discarded, of course, in favor of the new rudder. As for the old transom, it is well to retain it as a bulkhead. An opening may be cut into the old transom for access to the stowage space aft of it. But if desired, the old transom may be removed *after* the frames and deck beams are in place.

The new rudder is made as stipulated in drawn details. The rudder of boiler plate is welded to the iron pipe, which serves as the rudder post. The rudder post housing is fitted between the deck and keel and is flanged into position. Fit a rubber gasket at the keel end of the rudder post housing to make it water-tight.

It will be necessary to add on to the deadwood of the keel to fill in the space between the new rudder post and the after edge of the existing deadwood. Use the same stock lumber as the existing deadwood and secure the extension of the deadwood with iron straps, ¼" by 1½" by 10", bolted through the deadwood. Fastened with three inch lag-screws, a heavy iron strap, ⅜" by 1¾", should be put on the bottom edge of the deadwood.

"Panda" Jiggle Wagon

[*Continued from page* 153]

the center of the wheels. This must turn freely. Three short bars of ¼" stock ½"x5½" having a ⅜" notch in each end are slipped through the slots and the notches set over the two long bars attached to the wheels. The three heads are cut from ½" stock and a ¼" dowel 5¼" long glued into each. These are slipped into the holes in the wagon section. The toy is painted in gay colors and the moving parts soaped. As the wheels turn the bars on each side revolve and force the three crossbars up and down. These in turn move the heads.

YOU Can Win CASH, Too!

ON PAGES 68-75 appear pictures of valuable prizes to be given free to readers of MECHANIX ILLUSTRATED. You probably know all about the big contest by now, but you must have several friends who would like to know about the "Buildwords" game and the valuable prizes, too.

There are enough prizes for all, so why not make a list of friends you know will be interested in this contest and who you believe have the skill to win?

By so doing, you may win one hundred dollars, cash!

See your friends personally, telephone them, or send them one of the coupons at the bottom of this page. Be sure they put YOUR NAME on the contest entry blank as sponsor.

That's all you have to do!

If one of your friends wins a prize, YOU, as his or her sponsor, will be eligible for a *cash* prize for having introduced a prize winner to the contest.

The person who sponsors the winner of the biggest prize will receive $100. The sponsor of the individual winning the second largest prize will get $50. The sponsor of the winner of the third largest prize will get $25. In addition, there are five more prizes of $5 each.

That doesn't mean you have to sponsor the winner of the 1st prize (an Aeronca airplane) to win $100. The winner of the first prize may not have a sponsor. The $100 may be won by someone sponsoring a minor prize winner!

Sponsoring one or more of your friends does not injure your chances of winning a prize in the "Buildwords" contest, but gives you a chance to take in a CASH PRIZE as well as one of the big contest prizes.

All you have to do is let your friends in on this big contest. Tell them to put you down as their sponsor and you automatically become eligible for a cash sponsorship prize!

Be sure, though, that you, as sponsor, select entrants skillfully, sponsoring those persons you believe are capable of winning a prize in the "Buildwords" contest. You may sponsor members of your family.

SPONSOR PRIZES	
1st Prize	$100
2nd Prize	$ 50
3rd Prize	$ 25

In addition, there are five more prizes of $5 each!

Dear.....

I think you can win an Aeronca airplane or $1,500 in War Bonds!
If not the airplane, one of nearly a hundred other valuable items. For details see the "BUILDWORDS" contest in the magazine MECHANIX ILLUSTRATED. It's now only 10c at all newsstands.
I hope you enter. If you do, I may win $100 as your sponsor. Don't forget, put my name down on your entry blank as sponsor!
There are no catches in this contest. No slogans to think up. No essays to write. The highest score wins and I'm sponsoring you because I think you can win.

Your friend

.....

Dear.....

I think you can win an Aeronca airplane or $1,500 in War Bonds!
If not the airplane, one of nearly a hundred other valuable items. For details see the "BUILDWORDS" contest in the magazine MECHANIX ILLUSTRATED. It's now only 10c at all newsstands.
I hope you enter. If you do, I may win $100 as your sponsor. Don't forget, put my name down on your entry blank as sponsor!
There are no catches in this contest. No slogans to think up. No essays to write. The highest score wins and I'm sponsoring you because I think you can win.

Your friend

.....

Exploring Life

[*Continued from page* 180]

beam are battered by the speeding particles, and have protons or neutrons added or knocked off.

There are less than forty cyclotrons in the world today. Most of these are in the United States, and three are on the University of California campus. Present California facilities and studies, however, will be dwarfed in another two years when the new cyclotron, now under construction, is completed. Financed from grants, chiefly a million and a half dollars from the Rockefeller Foundation, this new cyclotron will weigh 4,900 tons. Its oscillator will manage 2,500,000 watts, and it will emit a beam of approximately 200,000,000 electron volts.

A new system of cooperative research is to be inaugurated on the California campus when the Medical Physics Laboratory is completed. Researchers with radioactive elements have felt the need of combining and integrating the work in different fields of science: physics, chemistry, and the various biological subjects, to gain the best results in their radioactive studies. A biologist studying certain chemical reactions with radioactive tracers can go farther and faster in his research with the assistance of an organic chemist. A physicist may cooperate with a bacteriologist in solving some medical problem.

"We feel that the great opportunity for the future in scientific research is the gathering together of a great number of men with different special trainings to work on a single problem," Dr. John Lawrence said. "As many as 50 men may be working on one problem at one time."

The International Cancer Research Foundation recently offered to finance a new building, with equipment and staff salaries for five years, to carry out this ideal of cooperative research.

For though few scientists are interested in the cyclotron's possibilities for changing lead into gold, all are intensely eager to change sickness into health and to increase the abundance for living through improved methods of food production and control of destructive pests.

AMERICA IN 1950

IF THE JAPS WIN . . .

. . . public houses of prostitution will be licensed by the government, just as they are in Japan. And there'll be no end of attractive inmates—for the latter will be our wives and sisters and daughters!

IF AMERICA WINS . . .

. . . slavery of every kind will be a thing of the past, for that's what we're fighting for—with our purchases of War Bonds and Stamps.

Modern Houses Of Earth

[*Continued from page* 154]

evenly distributed. This will give you about a moisture content of 7% to 8%. Try this now by ramming a four-inch layer of the soil into the form. If the soil seems to pulverize from the rammer blows instead of compressing, it is too dry. The soil should be dampened until the proper moisture content is obtained. When the soil compresses you will know that you have a sufficient amount of water in your soil mixture. Thus, you can determine the correct moisture needed to properly ram your soil.

You can avoid the technical moisture calculation, if desired, and find the right amount of moisture needed by experimental ramming. Tamp a layer of soil in the form; if it compresses, there is sufficient moisture in the soil; if it does not compress, moisten the soil lightly, and ram again. Repeat this, if necessary, until the proper consistency is obtained. After a little experience, you will be able to judge the soil by its appearance.

When this form is filled by repeated ramming of four-inch layers of earth, turn it completely over. Now it may be possible to lift off the form. If the form sticks, remove the bolts and lift off the base and sides. If this is done carefully, the rammed earth cube should have unbroken corners and edges. The top of the rammed earth should be protected from rain. This earth cube will indicate that your soil is good for rammed earth walls if it continues to increase daily in density and compactness, as its natural moisture dries, without cracking or crumbling. If it cracks it may mean that the soil needs to be blended with sand or sandy soil; make more test cubes from different blends of soil and sand until you discover the proper ratio. If the rammed earth crumbles, clay may be needed in the soil. The correct amount necessary can be determined also in the same way; by making more rammed earth test cubes of different blends of soil to clay until a successful admixture is found. Sometimes straw is used for mixing with soils that crack excessively.

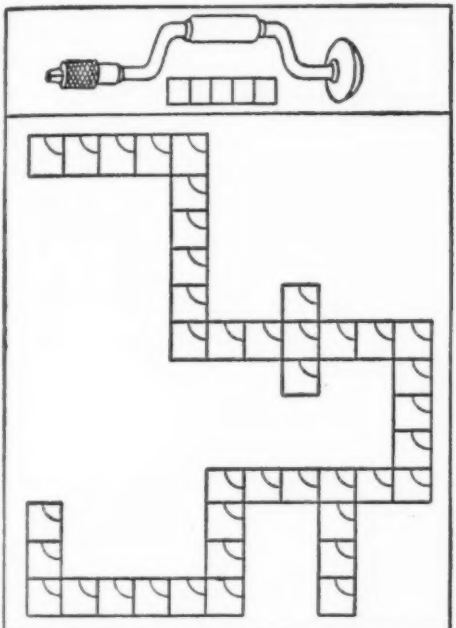
Many builders believe that the addition of straw weakens rammed earth, but on the contrary, recent laboratory tests by the University of California Agricultural Experiment Station show that straw may increase the compressive strength of rammed earth walls by as much as 80%. Although the proportion of straw will vary according to the soil, the usual amount is one inch of loose straw scattered over a five inch thickness of loose soil. Straw in lengths of two to six inches is easiest to use. Any exposed straw on the rammed earth walls can be easily removed by burning with a blow torch.

To find out the amount of asphaltic emulsion needed to stabilize your rammed earth, you must make some more tests, using the soil material

[*Continued on page* 184]

PUZZLE NO. 1

Here is a reprint of Puzzle No. 1 in the great MI "BUILDWORDS" contest. You may use this —or a reasonable copy of it—as your official entry.



LETTER VALUE CHART

A — 2	G — 6	M — 7	T — 2
B — 3	H — 3	N — 3	U — 3
C — 4	I — 2	O — 1	V — 5
D — 3	J — 4	P — 2	W — 6
E — 1	K — 7	Q — 1	X — 3
F — 5	L — 8	R — 4	Y — 7
		S — 3	Z — 4

MY HIGH SCORE IS

NAME .....

ADDRESS .....

CITY ..... STATE .....

If you were sponsored in this contest fill out the following. If not, leave these spaces blank.

SPONSOR'S NAME .....

ADDRESS .....

CITY ..... STATE .....

Save this puzzle and Puzzle No. 2, appearing on page 77 of this issue, until you have completed Puzzle No. 3 appearing in the April issue of MECHANIX ILLUSTRATED. Send all three completed puzzles in together.

AMAZING NEW DISCOVERY FOR WOODWORKERS

A MIRACULOUS new discovery in electro-chemistry now opens up untold possibilities for the home craftsman . . . **Metalized Wood!** By an easy, simple three-step process, you can now permanently protect and artistically beautify any and every wood object with a heavy lifetime covering of actual metal. Copperclad Ashtrays, Burnished-Gold Cigarette Boxes, Antiqued-Bronze Book Ends, Gleaming Silver Airplane and Ship Models are but a few examples—*every one a genuine work of art*, a masterpiece in metal-and-wood you'll be proud to show your family, relatives and friends!

UNLIMITED DECORATIVE POSSIBILITIES! Solid Surfaces, Beautiful Inlay Effects!

Nothing you've seen or ever tried compares with this! By means of an altogether new *electrolytic* method of applying and binding metal to wood, you can achieve remarkable results the very first time . . . **A Layer of Metal So Strong You Can Machine Buff It If Desired!** Rich Burnished Effects, Dull Satin Contrasts, Gleaming Silver and Gold Overlays of Initials, Flowered Designs, on Fine Filigree Work and Intricate Carving.

COMPLETE INSTRUCTIONS SENT FREE!

Here is a fascinating sparetime hobby that can be profitable as well. *Just think!* . . . At a cost of a few cents you can transform an ordinary box into a Jewel Case that would sell in stores for as much as five dollars! So why not be first in your neighborhood? *Don't delay!* WRITE TODAY FOR FREE INSTRUCTIONS!

WARNER RESEARCH LABORATORIES, Dept. W-4
215 W. OHIO STREET • CHICAGO, ILLINOIS

BUILD ARC WELDER FROM OLD GENERATOR
WE SHOW YOU HOW
Light or Heavy Work

Produces 30-200 amperes. Takes no previous experience or hard work to make one of these welders. Complete plans 35c. Send for your **PLANS** today and we'll include FREE our Big NEW Catalog listing 1000 electrical bargains.

LEJAY MFG. 1314 LEJAY BLDG. MINNEAPOLIS, MINN.

BUY UNITED STATES BONDS & STAMPS

AUTOMOBILE RACING BOOK (Fifth Edition Revised)

12 Chapters, 77 Illustrations dirt track, championship and midget cars. How to build engines, chassis and bodies. Why the fast ones are fast and how to make them fast. How to speed up Ford V-8 cars and rebuild Ford A and B engines. How world's record cars are built. Official AAA midget rules and international formula. Order NOW! $1.00 Postpaid; $1.15 C. O. D. Money back if not satisfied.

RAY F. KUNS, Dept. A-47, Madisonville, Cincinnati, Ohio

PATENT YOUR IDEAS HOW TO OBTAIN A PATENT
SEND FOR FREE BOOK →

Written by a Former Member of the Examining Corps (1922-24) of the U.S. Patent Office.

CARL MILLER, Registered Patent Attorney
Former Member Examining Corps U. S. Patent Office

Woolworth Bldg., Dept. 33-B, New York—Bond Bldg., Dept. 33-B, Washington, D. C.
Please send me your Free Book, How to Obtain a Patent, and "Record of Invention" form.

NAME .....

ADDRESS .....

SHEET METAL INFORMATION ON LAYOUTS

NOW READY!

SIZE 7" x 10" x 2" 1125 PAGES

A practical, illustrated Encyclopedia covering all phases of Sheet Metal Work including Pattern Cutting, Pattern Development, and Shop Procedure – Developed by experts for Sheet Metal Workers, Layout Men, Mechanics, and Students.

1001 KEY FACTS AT YOUR FINGER ENDS

10 Big Sections, 350 Layouts, 1600 Illust. FULLY INDEXED FOR READY REFERENCE in answering your layout problems. Easy to read and understand. Well printed in clear type. Flexible covers.

$4 COMPLETE • PAY ONLY $1 A MO.

To get this assistance for yourself simply fill in and mail order today.

AUDEL, Publishers, 49 West 23rd St., New York

Mail AUDELS SHEET METAL PATTERN LAYOUTS BOOK. Price $4 on 7 Days Free Trial. If O. K. I will remit $1 in 7 days and $1 monthly until $4 is paid. Otherwise I will return it.

NAME _____

ADDRESS _____

OCCUPATION _____

REFERENCE _____ MM

Now Only $9.95

REAL ENGINE VALUE

The G. H. Q. is a miniature gasoline engine that really operates. Over 15,000 sold in the last year. Now is your chance to buy the *New Improved* 1943 model for $9.95. *Absolutely complete* with coil, condenser, plug, instructions, etc. Every engine fully bench tested and ready to run. For boats, planes, midget cars, etc. Send only $1.—*Shipped Collect C. O. D. same day. Send for FREE circular or 6c for Jumbo catalog of hundreds of plane, boat and hobby items.*

GHQ MOTORS, Dept. AX, 40 East 21 St., New York, N. Y.

STAMP-COLLECTING IS ONE OF AMERICA'S MOST POPULAR HOBBIES

Our Stamp Dealer Advertisers will be glad to help you build an interesting collection. Take advantage of their friendly, cooperative service by writing to them today. You'll find them under Stamp Collecting in the MONEY-MAKERS & MONEYSAVERS SECTION (pages 27-31).

TRAILER BUILDERS' PARTS CATALOG

Complete plans and Building Instructions 25c

We'll save you money on everything. Largest and most complete trailer builders' supply house in the United States. Member TRAILER COACH MFRS.' ASSOC. Send 10c for parts catalog.

NATIONAL TRAILER EQUIPMENT CO.

719 N. Seventh St. Milwaukee, Wis.

Wood workers: *Here it is!* Harold

only 10c

Hunt's big REVISED No. 14 wood catalog! Latest, UP-TO-DATE IDEAS for experts and amateurs; SPECIAL BARGAINS in rare woods, veneers, and all kinds of supplies. 124 pages—12 showing rare woods in color. Get posted! Send only 10c to Craftsman Wood Service Co., 2729 S. Mary St., Dept. G-31, Chicago, Ill.

Modern Houses Of Earth

[*Continued from page* 182]

and moisture content that proved to be the best as discovered in the prior experiments. For the first test, mix about two quarts of asphalt emulsion to one cubic foot of dampened soil. If the soil is not damp before adding the asphaltic emulsion it is difficult to evenly distribute the stabilizer throughout the soil. Ram the form full and remove in the same manner as before. Now make another rammed earth cube using two and one half quarts of asphaltic emulsion to one cubic foot of soil. For the third test cube, use three quarts of the asphaltic emulsion to one cubic foot of the soil material. Be sure that these three rammed earth test cubes are clearly marked for identification of the ingredients. After these cubes have dried for one or two weeks, depending on the climate, test them by sprinkling with water for several hours, or if possible, submerge them in water in individual containers. The rammed earth cube that discolors the water the least and that remains the hardest, indicates the correct proportion of asphaltic emulsion to use with your soil.

Emulsified asphalt in the rammed earth not only makes it permanently waterproof but may highly increase the compression strength of the rammed earth wall.

Another method of stabilizing rammed earth is by mixing from 6% to 12% of Portland cement, by volume, depending on the soil material. Then the mixture is dampened to the optimum moisture content, which may be up to 15% of its total weight, depending also on the soil characteristics. The soil material is immediately put into the forms and compressed by ramming. It is then cured in from three to seven days by being kept moist. A sandy loam soil tested without any additions had, after ramming, a compressive strength of 85 pounds per square inch. This same soil with 6% of Portland cement added had about 650 pounds per square inch in compression. A 10% addition of Portland cement increased this same soil when rammed to a compression strength of 800 pounds per square inch. The compressive strength gained by using cement had not diminished after the rammed earth had been submerged in water for one hour. This stabilizing method, however, is usually costlier than the asphaltic emulsion stabilizing.

This concludes the first of three articles on rammed earth and adobe brick dwellings. The second article, detailing rammed earth construction, will appear in the April issue of Mechanix Illustrated. Don't miss it!

A step-by-step procedure of exercises and other acclimatization routines for airplane crews to follow before and during high altitude flights have been evolved by one aircraft company.

By providing irrigation, Grand Coulee Dam will create at least 20,000 new farms.

MOTORISTS *Wanted!*

TO MAKE THIS *UNIQUE TEST...*

of GAS SAVINGS

Car Owners: You are invited to make a gas saving road test with the Vacu-matic on your own car, with the absolute understanding that unless it proves to you that it will save you up to 30% on gas and improve your car performance, the test will cost you nothing. Investigate this remarkable discovery that trims dollars off gasoline bills—gives you worthwhile gas savings—more power—quicker starting—more miles on less gas.

Automatic Supercharge Principle

Vacu-matic is *entirely different!* It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air, into the heart of the gas mixture. It is entirely automatic and allows the motor to "breathe" at the correct time, opening and closing *automatically* to save dollars on gas costs.

Proven By Test

In addition to establishing new mileage records on cars in all sections of the country, the Vacu-matic has proven itself on thousands of road tests and on dynamometer tests which duplicate road conditions and record accurate mileage and horsepower increases.

Fits All Cars—Easy to Install

Vacu-matic is constructed of six parts assembled and fused into one unit, adjusted and *sealed at the factory.* Nothing to regulate. Any motorist can install in ten minutes. The free offer coupon will bring all the facts. Mail it today!

The Vacu-matic Co., Wauwatosa, Wis.

Sworn Proof of Gas Savings

This certifies that I have carefully read 300 original letters received from Vacu-matic users testifying to gas savings up to 30%, many reporting added power, smoother running, and quicker pick-up. These letters are just a small part of the larger file of enthusiastic user letters that I saw at the company offices.

Signed

Notary Public

AGENTS Get Yours FREE For Introducing

Vacu-matic offers a splendid opportunity for unusual sales and profits. Every car, truck, tractor, and motorcycle owner a prospect. Valuable territories now being assigned. If you help us introduce it to a friend, you can obtain your own free. Check and mail coupon today.

SEND THIS *Free Offer* COUPON

THE VACU-MATIC COMPANY
7617-774 W. State St., Wauwatosa, Wis.
Please send full particulars about VACU-MATIC, also how I may obtain one for my own car FREE. This does not obligate me in any way.

Name .....

Address .....

City ..... State .....

☐ Check here if interested in Agency Proposition.

Your Wartime Car

by Frederick C. Russell

If you have a problem with your car, ask Mr. Russell. Just send a stamped, self-addressed envelope for a personal reply.

What can I do to get more warmth from the hot water heater? I have installed a higher opening thermostat. L. K. J.

The heater may be mounted too high. Also the core may be clogged with sediment.

Try it!

Every little bit helps when trying to make rationed gas go farther. That's why it pays to check toe-in. Camber and caster have been in the limelight so much of late we are inclined to forget that if the front tires are dragged through excessive toe-in more power will be needed to propel the car.

The rear end of my car is a little noisy but the man who worked on it claims that because the gears are properly adjusted the noise will wear away. Is this true? S. L. L.

Yes. It is also true that a quiet rear end may not be in correct adjustment. In other words, silence is not the proof of correct mesh.

The engine of my car goes dead when slowed down to idling. Speeded up it seems to run normally. Valve clearances have been checked. R. L. A.

The carburetor needs further cleaning. Check for air leakage around manifolds and valve guides.

Both the clutch and brake pedals squeak when I use them. Have squirted penetrating oil over their shafts but this gives only temporary relief. W. Z. L.

There is a grease nipple on the pedal shaft which you can reach through a hole in the pan under your car.

There's a pool of water under the transmission every morning when I go to get my car. Can you suggest where the leakage may originate? C. F.

Look for a cylinder head gasket leak at the rear of the engine. Also check the car's heater connections.

Are tire chains just as effective used over smooth tires as on treads which have a good anti-skid pattern? W. M. B.

The tire tracks in the accompanying illustration show that treads are important to traction, chains or no chains.

Is there any way to tell when a rear tire is going flat while the car is in motion? H. T. M.

The car will wander over the road.

How much damage is done to a tire when its wheel is out of line? H. P.

The tire is dragged 87 feet per mile when its wheel is only ½ inch out of line.

I get a "hard pedal" when applying the brakes. Specifications call for semi-woven lining on this job and I've checked to make sure. Have you a suggestion? H. C. S.

The brake shoes are not centralized on their drums. The trouble is at the anchors.